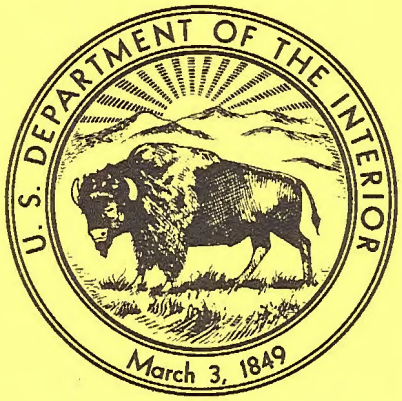
FINAL ENVIRONMENTAL STATEMENT FOR THE PROTOTYPE OIL SHALE LEASING PROGRAM

Volume IV of VI

Consultation and Coordination with Others



U.S. DEPARTMENT OF THE INTERIOR
1973

F I N A L

ENVIRONMENTAL STATEMENT

FOR THE

PROTOTYPE OIL SHALE LEASING PROGRAM

Volume IV of VI

Consultation and Coordination

with Others

Prepared in Compliance With

Section 102 (2) (c) of the National Environmental

Policy Act of 1969

Prepared by

UNITED STATES DEPARTMENT OF THE INTERIOR

1973

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SUMMARY

Final Environmental Statement
Department of the Interior, Office of the Secretary

1. Administrative type of action:

2. Brief description of action:

This action would make available for private development up to six leases of public oil shale lands of not more than 5,120 acres each. Two tracts are located in each of the States of Colorado, Utah, and Wyoming.

Such leases would be sold by competitive bonus bidding and would require the payment to the United States of royalty on production. Additional oil shale leasing would not be considered until development under the proposed program had been satisfactorily evaluated and any additional requirements under the National Environmental Policy Act of 1969 had been fulfilled.

3. Summary of environmental impact and adverse environmental effects:

Oil shale development would produce both direct and indirect changes in the environment of the oil shale region in each of the three States where commercial quantities of oil shale resources exist. Many of the environmental changes would be of local significance, and others would be of an expanding nature and have cumulative impact. These major regional changes will conflict with uses of the other physical resources of the areas involved. Impacts would include those on the land itself, on water resources and air quality, on fish and wildlife habitat, on grazing and agricultural activities, on recreation and aesthetic values, and on the existing social and economic patterns as well as others. The environmental impacts from both prototype development at a level of 250,000 barrels per day of shale oil and an industry producing a possible 1 million barrels per day by 1985 are assessed for their anticipated direct, indirect and cumulative effects.

4. Alternatives considered:

A. Government development of public oil shale lands.
B. Change in number of tracts to be leased.
C. Delay in development of public oil shale lands.
D. No development of public oil shale lands.
E. Unlimited leasing of public oil shale lands.
F. Obtaining energy from other sources.

5. Comments have been requested from the following:

Federal agencies, State agencies, and private organizations listed in Volume IV, Section F.

6. Date made available to the Council on Environmental Quality and the Public:

Draft Statement: September 7, 1972

Final Statement: August, 1973

INTRODUCTORY NOTE

THIS FINAL ENVIRONMENTAL STATEMENT HAS BEEN PREPARED PURSUANT TO SECTION 102 (2) (C) OF THE NATIONAL ENVIRONMENTAL POLICY ACT OF 1969 (42 U.S.C. SECS. 4321-4347). ITS GENERAL PURPOSE IS A STUDY OF THE ENVIRONMENTAL IMPACTS OF OIL SHALE DEVELOPMENT.

THE SECRETARY OF THE INTERIOR ANNOUNCED PLANS ON JUNE 29, 1971, FOR THIS PROPOSED PROGRAM AND RELEASED A PRELIMINARY ENVIRONMENTAL STATEMENT, A PROGRAM STATEMENT, AND REPORTS PREPARED BY THE STATES OF COLORADO, UTAH, AND WYOMING ON THE ENVIRONMENTAL COSTS AND PROBLEMS OF OIL SHALE DEVELOPMENT.

THE PROPOSED PROGRAM IS IN CONCERT WITH THE PRESIDENT'S ENERGY MESSAGE OF JUNE 4, 1971, IN WHICH HE REQUESTED THE SECRETARY OF THE INTERIOR TO INITIATE "A LEASING PROGRAM TO DEVELOP OUR VAST OIL SHALE RESOURCES, PROVIDED THAT ENVIRONMENTAL QUESTIONS CAN BE SATISFACTORILY RESOLVED."

AS PART OF THE PROGRAM, THE DEPARTMENT AUTHORIZED INFORMATIONAL CORE DRILLING AT VARIOUS SITES IN COLORADO, WYOMING, AND UTAH AND 16 CORE HOLES WERE COMPLETED. THE DEPARTMENT REQUESTED NOMINATIONS OF PROPOSED LEASING TRACTS ON NOVEMBER 2, 1971, AND A TOTAL OF 20 INDIVIDUAL TRACTS OF OIL SHALE LAND WERE NOMINATED. WITH THE CONCURRENCE OF THE CONCERNED STATES, THE DEPARTMENT OF THE INTERIOR ANNOUNCED ON APRIL 25, 1972, THE SELECTION OF SIX OF THESE TRACTS, TWO EACH IN COLORADO, UTAH, AND WYOMING.

THE PROGRAM IS ESSENTIALLY UNCHANGED FROM THAT ANNOUNCED ON JUNE 29, 1971, BUT THE PRELIMINARY STATEMENT ISSUED AT THAT TIME

WAS EXPANDED TO CONSIDER THE IMPACT OF MATURE OIL SHALE DEVELOPMENT, THE IMPACT OF DEVELOPMENT OF THE SIX SPECIFIC TRACTS, AND A COMPREHENSIVE ANALYSIS OF OTHER ENERGY ALTERNATIVES.

THE DRAFT OF THIS FINAL ENVIRONMENTAL STATEMENT WAS RELEASED TO THE PUBLIC ON SEPTEMBER 7, 1972. A PUBLIC REVIEW PERIOD WAS HELD THAT ENDED ON NOVEMBER 7, 1972. THIS REVIEW PROVIDED IMPORTANT INFORMATION UPON WHICH TO EXPAND AND CORRECT, WHERE APPROPRIATE, THE DRAFT MATERIAL.

VOLUME I OF THIS FINAL SET OF SIX VOLUMES PROVIDES AN ASSESSMENT OF THE CURRENT STATE OF OIL SHALE TECHNOLOGY AND DESCRIBES THE REGIONAL ENVIRONMENTAL IMPACT OF OIL SHALE DEVELOPMENT AT A RATE OF ONE MILLION BARRELS PER DAY BY 1985. VOLUME II EXTENDS THIS STUDY WITH AN EXAMINATION OF ALTERNATIVES TO THE ONE MILLION BARREL PER DAY LEVEL OF SHALE OIL PRODUCTION. VOLUMES I AND II THUS CONSIDER THE REGIONAL AND CUMULATIVE ASPECTS OF A MATURE OIL SHALE INDUSTRY.

VOLUME III EXAMINES THE SPECIFIC ACTION UNDER CONSIDERATION, WHICH IS THE ISSUANCE OF NOT MORE THAN TWO PROTOTYPE OIL SHALE LEASES IN EACH OF THE THREE STATES OF COLORADO, UTAH, AND WYOMING. ITS FOCUS IS ON THE SPECIFIC ENVIRONMENTAL IMPACTS OF PROTOTYPE DEVELOPMENT ON PUBLIC LANDS WHICH, WHEN COMBINED, COULD SUPPORT A PRODUCTION POTENTIAL OF ABOUT 250,000 BARRELS PER DAY.

VOLUME IV DESCRIBES THE CONSULTATION AND COORDINATION WITH OTHERS IN THE PREPARATION OF THE FINAL STATEMENT, INCLUDING COMMENTS RECEIVED AND THE DEPARTMENT'S RESPONSES. LETTERS RECEIVED DURING THE REVIEW PROCESS ARE REPRODUCED IN VOLUME V, AND ORAL TESTIMONY IS CONTAINED IN VOLUME VI.

THIS DOCUMENT IS BASED ON MANY SOURCES OF INFORMATION, INCLUDING RESEARCH DATA AND PILOT PROGRAMS DEVELOPED BY BOTH THE GOVERNMENT AND PRIVATE INDUSTRY OVER THE PAST 30 YEARS. MANY FACTORS, SUCH AS CHANGING TECHNOLOGY, EVENTUAL OIL PRODUCTION LEVELS, AND ATTENDANT REGIONAL POPULATION INCREASES ARE NOT PRECISELY PREDICTABLE. THE IMPACT ANALYSIS INCLUDED HEREIN IS CONSIDERED TO CONSTITUTE A REASONABLE TREATMENT OF THE POTENTIAL REGIONAL AND SPECIFIC ENVIRONMENTAL EFFECTS THAT WOULD BE ASSOCIATED WITH OIL SHALE DEVELOPMENT.

IT SHOULD BE NOTED THAT SUBSTANTIAL AMOUNTS OF PUBLIC LANDS IN ADDITION TO THE PROTOTYPE TRACTS WOULD BE REQUIRED FOR AN INDUSTRIAL DEVELOPMENT TO THE ONE MILLION BARREL PER DAY LEVEL CONSIDERED IN VOLUMES I AND II. IF EXPANSION OF THE FEDERAL OIL SHALE LEASING PROGRAM IS CONSIDERED AT SOME FUTURE TIME, THE SECRETARY OF THE INTERIOR WILL CAREFULLY EXAMINE THE ENVIRONMENTAL IMPACT WHICH HAS RESULTED FROM THE PROTOTYPE PROGRAM AND THE PROBABLE IMPACT OF AN EXPANDED PROGRAM. BEFORE ANY FUTURE LEASES ON PUBLIC LANDS ARE ISSUED, AN ENVIRONMENTAL STATEMENT, AS REQUIRED BY THE NATIONAL ENVIRONMENTAL POLICY ACT, WILL BE PREPARED.

AVAILABILITY OF FINAL ENVIRONMENTAL STATEMENT

The six-volume set may be purchased as a complete set or as individual volumes from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402; the Map Information Office, Geological Survey, U.S. Department of the Interior, Washington, D. C. 20240; and the Bureau of Land Management State Offices at the following addresses: Colorado State Bank Building, 1600 Broadway, Denver, Colorado 80202; Federal Building, 124 South State, Salt Lake City, Utah 84111; and Joseph C. O'Mahoney Federal Center, 2120 Capital Avenue, Cheyenne, Wyoming 82001.

Inspection copies are available in the Library and the Office of the Oil Shale Coordinator, U.S. Department of the Interior, Washington, D. C., and at depository libraries located throughout the Nation. The Superintendent of Documents may be consulted for information regarding the location of such libraries. Inspection copies are also available in Denver, Colorado, in the Office of the Deputy Oil Shale Coordinator, Room 237E, Building 56, Denver Federal Center, Denver, Colorado 80225, in all the Bureau of Land Management State Offices listed above, and in the following Bureau of Land Management district offices: Colorado: Canon City, Craig, Glenwood Springs, Grand Junction, Montrose; Utah: Vernal, Price, Monticello, Kanab, Richfield; Wyoming: Rock Springs, Rawlins, Casper, Lander, Pinedale, Worland.

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Chapter I. Consultation and Coordination

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I. CONSULTATION AND COORDINATION IN THE PREPARATION OF THE FINAL ENVIRONMENTAL STATEMENT

Planning the Prototype Oil Shale Leasing Program, including the preparation of this Final Environmental Statement, has required three years of study and coordination, and was accomplished through the efforts of a multidiscipline task force. This volume discusses the concept of this organization, details the planning activities, and presents the comments received during the review process and the Department's responses.

A. Oil Shale Task Force

Oil shale development presents a complex problem of resource management. To examine the situation in its entirety, the Secretary of the Interior established an Oil Shale Task Force. Its charter was to develop a model administrative approach; draft a prototype oil shale leasing program; prepare the environmental analysis; and implement the program, if approved. The charter provided the basis for action, but an organization was needed that could assume responsibility for planning and coordination. 1/

Congressional directives provide policy guidelines to any action that may be taken on public lands. The policy of Congress, embodied in the mineral leasing laws, has been recently supplemented by the Mining and Minerals Policy Act of 1970. That act reaffirms the policy of the Federal Government to foster and encourage the

1/ Stone, Reid T. and Harry R. Johnson. Environmental Planning for New Energy Resource Development on Public Lands. Presented at the 47th Annual Fall Meeting of the Society of Petroleum Engineers of AIME, San Antonio, Tex., October 8-11, 1972.

orderly development of mineral resources by private enterprise. The Secretary of the Interior has been assigned the responsibility to implement those policy directives in exercising his authority under the various leasing laws.

Within the general framework established by the Congress, and at the request of the President,[1/] specific policies for the prototype oil shale program have been developed by the Department of the Interior. As indicated in Figure I-1, program responsibility was assigned to the Department's Assistant Secretaries for Energy and Minerals, and Land and Water Resources. Other major entities within the Department reviewed evolving policy to assure that divergent interests were reconciled. This arrangement provided an effective internal system of checks and balances.

Liaison between the development of the program, including preparation of the Environmental Statement, and evolving policy, was provided by the Office of the Oil Shale Coordinator. Bureaus and Offices provided program support, including professional, technical, and clerical assistance. The Oil Shale Task Force (Figure I-2) performed four basic functions: (1) assessment of oil shale technology; (2) interpretation of pertinent resource information; (3) detailed program planning, including the preparation of the environmental statement; and (4) preparation of the leasing terms, including a means of enforcement.

1/ See: Clean Energy Message from the President of the United States, 93rd Congress, 1st Session, Document No. 92-118, June 4, 1971.

Figure I-1.- Program Policy and Coordination - Prototype Oil Shale Leasing Program

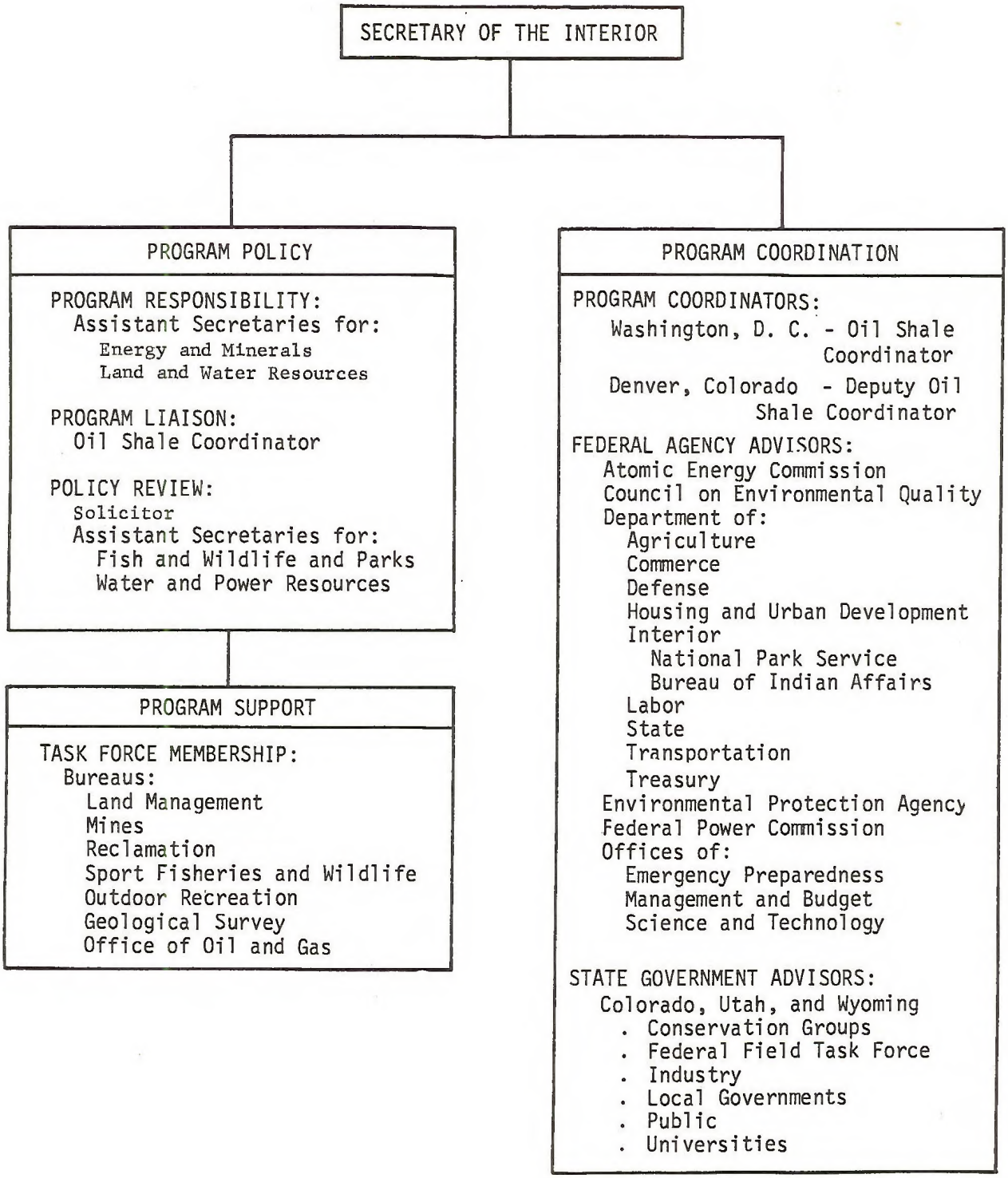
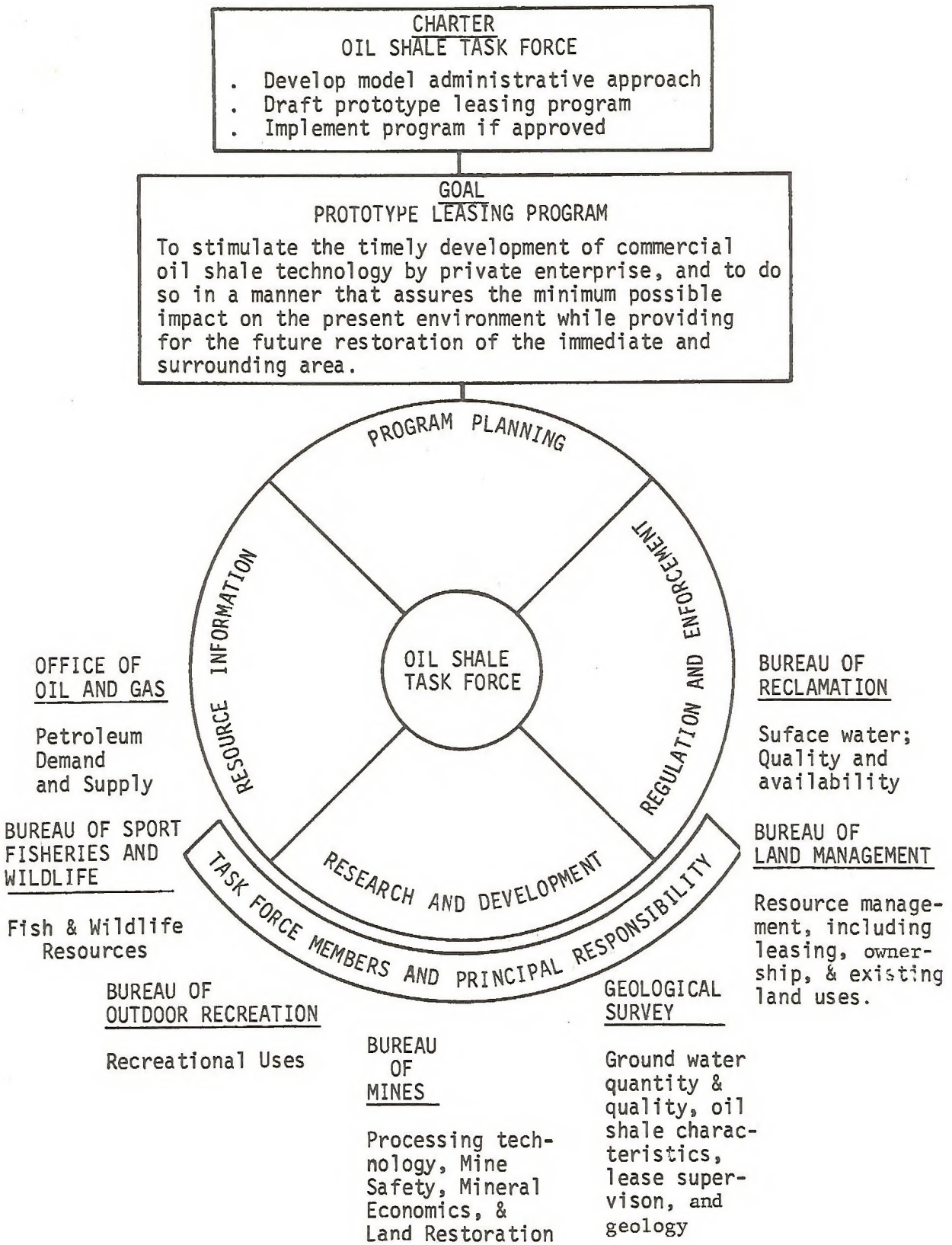


Figure I-2.- Program Development - Prototype Oil Shale Leasing Program



The Oil Shale Coordinator also served as the principal working contact with other Federal agencies and the State Governments of Colorado, Utah, and Wyoming (Figure I-1). Oil shale panels, established by the Governors of each of the involved States at the request of the Secretary, provided a means of program participation by various conservation groups, private enterprise, local governments, the public, and universities. The organization created in Colorado is the largest of the State panels and currently consists of 43 advisors to the Governor and a separate regional planning group of 18 members. The State is now spearheading a State-Federal-private enterprise continuing study of the potential environmental impacts from oil shale development, including a detailed assessment of land-use requirements (See Chapter III, Section I.12 of this volume).

Most of the Federal agencies listed in Figure I-1 were involved in the program and preparation of the Environmental Impact Statement (EIS) since its inception. The type of involvement varied; many organizations wished only to be kept informed, some have defined views or regulatory responsibilities that need to be reflected in the evolving program and EIS, and others have factual information that is needed to complete evaluation studies. To effect the interchange with other agencies, a series of coordination meetings were held as major planning stages were reached in the evolution of the program. Another important phase of the program was to release for public comment the various studies used to develop the draft environmental statement released in September 1972. Written comments on the text totaled nearly 2,000 pages, and 95 individuals appeared at public hearings held during October 1972.

The program policy and coordination aspects of the prototype oil shale leasing program involved over 40 distinct organizational entities (Figure I-1). The Final Environmental Statement reflects the extensive consultation and coordination that has been an integral part of the prototype oil shale leasing program.

B. Past Planning Activities

October 1969 - An oil shale study was initiated by the Assistant Secretary--Mineral Resources and the Assistant Secretary--Public Land Management.1/

October - December 1969 - Review of Mineral Leasing Act and previous Departmental efforts to lease oil shale resources in public lands.

December 1969 - Oil Shale Task Force formally established to draft a prototype oil shale leasing program proposal and to implement a program if approved.

May 1970 - Proposed program presented to the Secretary of the Interior, who directed that additional environmental analyses be made prior to program implementation.

May - June 1970 - The Governors of Colorado, Wyoming, and Utah formed State Committees to study the environmental impact and related costs for appropriate environmental controls.

June 1970 - Public meetings conducted in each State on the proposed prototype leasing program.

August 1970 - Officials of private, State, and Federal agencies conducted a week-long field survey of sites typical of those that may be developed.

August 1970 - December 1972 - Twenty-five oil shale meetings held in the three-State area (Colorado, Utah, and Wyoming).

February 1971 - State Governors formally transmitted to the Secretary of the Interior an evaluation of the environmental impact of oil shale development as related to the resources in their States.

1/ Now Assistant Secretaries for Energy and Minerals and Land and Water Resources, respectively.

March - June 1971 - Interior's Preliminary Draft Environmental Statement and Program Statement for a Prototype Oil Shale Leasing Program were prepared and submitted for public review.

June 1971 - Informational core drilling authorized and carried out on public oil shale lands in Colorado, Utah, and Wyoming. Over $2 million spent by private firms on 16 holes aggregating 24,647 feet of drilling for exploring and evaluating Federal lands prior to submitting nominations for leases by February 1, 1972. Surface area was restored, and the entire operation was conducted without significant environmental impact.

September 1971 - Board of County Commissioners of Garfield, Rio Blanco, Mesa Counties, Colo., creates an Oil Shale Regional Planning Commission.

November 1971 - Department of the Interior published notice of call for nominations of areas for oil shale leasing. Fifteen companies submitted 17 nominations on 13 separate tracts in Utah and Colorado, and one nomination on one tract in Wyoming. The 23 industry nominations on 18 separate tracts in the three States were supplemented by two additional tracts nominated by the Governor of Wyoming.

January 31, 1972 - Lease nominations were closed.

February - April 1972 - The nominated tracts were reviewed by a selection committee of Federal and State experts, in order to recommend a total of six tracts, two in each State, for competitive-bid leasing. The six recommended tracts were further reviewed by the Department of the Interior, and by representatives of the Governor's Task Force in each of the three States, and the final selections were announced on April 25, 1972.

April - September 1972 - Revised draft environmental statement was prepared by Interior and published in three volumes describing (1) a regional overview of the expected environmental impact of a prototype oil shale leasing program and the projected impact of a mature 1-million-barrel-per-day shale oil industry; (2) a discussion of other energy sources which may be considered as alternatives to the development of oil shale; and (3) an analysis of the impact of development of six specific proposed lease tracts.

October 1972 - Public hearings held in the cities of Denver and Grand Junction, Colo.; Salt Lake City and Vernal, Utah; Cheyenne and Rock Springs, Wyo. Public review process extended from October 23, 1972, to November 7, 1972, by the Secretary of the Interior.

November 1972 - August 1973 - Oil Shale Task Force reviewed all public comments and prepared the Final Environmental Statement.

C. Proposed Schedule of Future Actions

It is proposed that the following schedule of activities be implemented if, after issuance of the Final Environmental Statement, the decision is made to proceed with the program:

1. A notice of the proposed lease sale would be published, fixing the date of the first sale 30 days or more after initial publication of notice.

2. The six lease sales would be held in sequence, at 14-day intervals, in the appropriate State Bureau of Land Management offices. The proposed order of sale would be Tracts C-a, C-b, U-a, U-b, W-a and W-b.

Prior to the approval of the detailed mining plan, which is required by the third anniversary date of the lease for each of the selected tracts, the Department would hold public hearings on these plans for each tract in the county in which the tract is located. Members of the Technical Advisory Board would participate in order to obtain public comments on the adequacy of the plans proposed for environmental protection.

D. Agency Participation

Personnel from the following Federal and non-Federal organizations have participated in the environmental analysis of the program and preparation of the environmental statement through direct participation, as consultants, or in review or observer capacities:

1. Federal Agencies

a. Department of the Interior

Oil-Shale Task Force - Staff selected from the Buréau of Mines, Bureau of Land Management, Bureau of Reclamation, Bureau of Sport Fisheries and Wildlife, Bureau of Outdoor Recreation, and U.S. Geological Survey.

b. Department of Agriculture - Soil Conservation Service

c. Department of Health, Education, and Welfare

d. Department of Housing and Urban Development

e. Department of the Treasury

f. Department of Defense - Office of Naval Petroleum Reserves

g. Atomic Energy Commission

h. Federal Power Commission

i. Environmental Protection Agency

2. Non-Federal Agencies and Organizations

a. State Agencies

- State of Colorado, Director of Natural Resources - Special Committee on Economics of Environmental Protection, Governor's Oil-Shale Advisory Committee

- State of Utah, Department of Natural Resources - Committee on Environmental Problems of Oil Shale

- State of Wyoming, Department of Economic Planning and Development - Wyoming Oil-Shale Environmental Planning Committee

b. Local Agencies

- Oil-Shale Regional Planning Commission - Garfield, Mesa, and Rio Blanco Counties, Colorado

c. Private Groups

- Private Industry participants in the exploratory core drilling and tract nomination program included the following companies:

American Petrofina Co. of Texas, Ashland Oil, Inc., Atlantic Richfield Co., Barodynamics, Inc., Occidental Petroleum Corp., Geokinetics, Inc., Gulf Minerals Resources Co., Marathon Oil Co., The Oil Shale Corp., Phelps Dodge Corp., Shell Oil Co., SOHIO Petroleum Co., The Superior Oil Co., Sun Oil Co., Western Oil Shale Corp.

- Conservation Groups that have participated in oil shale field trips and public orientation meetings have included: Denver Audubon Society, Colorado Open Space Council, Thorn Ecological Institute, Colorado State Rehabilitation Sub-Committee.

E. Field Briefings

The summary below recounts various meetings, briefings, and field inspection tours in which Departmental staff have participated in order to inform and obtain the views of parties interested in the prototype oil shale leasing program.

DEPARTMENT OF INTERIOR

MAJOR OIL SHALE FIELD TRIPS
AND
PUBLIC ORIENTATION MEETINGS
FROM
June 1971 to July 28, 1972

PURPOSE	DATE	PLACE	REMARKS
Regional Development and Land Use Planning Comm. Meeting	June 1, 1971	Rifle, Colo.	Regional Dev. and Land Use Plan. Comm meeting with Piceance Creek Basin Region County Commissioners, mayors, and planning commissioners, briefing and slide show presentation
Denver Audubon Oil Shale Briefing Prior to Field Trip	July 1, 1971	Denver, Colo.	Slide show presentation before Denver Audubon Society describing the proposed prototype oil shale program along with discussion from several of the oil shale task force members and industry.
Denver Audubon Oil Shale Tour	July 1971	Piceance Creek Basin	Field trip to Colorado oil shale area and present industry operations.
Colorado State Rehabilitation Subcommittee Field Trip	Aug. 1971	Piceance Creek Basin	Field study group considering further work for environmental protection.
Colorado Open Space Council Environmental Briefing	Aug. 1971	Denver, Colo.	Briefing on proposed oil shale program announced June 29, 1971 - Council is composed of representatives of various environmental groups in the area.
Secretary of the Interior Oil Shale Tour	Aug. 1971	Parachute Creek and Anvil Points	Field trip and briefing for Secretary, two Senators, one Congressman, Lt. Governor, government officials, industry officials and press.
Briefing for Colorado Bar Association on proposed Prototype Program	Oct. 1971	Colorado Springs, Colo.	Slide - tape show presented at annual meeting and discussed.
Oil Shale Regional Planning Commission Tour	Oct. 1971	Piceance Creek Basin	Tour of Colony mine and facilities, Shell core drilling site, and general Colorado oil shale area.

PURPOSE	DATE	PLACE	REMARKS
Utah Geological Society Speech	Nov. 1971	Salt Lake City, Utah	Speech before Utah Geological Society presenting proposed oil shale program including slide show.
Proposed Prototype Oil Shale Program Presentation	Feb. 1972	Boulder, Colo.	Oil shale talk including presentation of the prototype oil shale leasing program at the University of Colorado Journal Club Meeting .
Interior Department Public Relations Field Trip	Feb. 1972	Piceance Creek Basin	Tour for Mr. Charles Wallace, Interior Dept. Public Relations to the Basin and adjacent western slope areas.
Proposed Prototype Oil Shale Program Presentation	March 1972	Denver, Colo.	Youth Advisory Board to the EPA - National meeting at the Cosmopolitan Hotel.
Proposed Prototype Oil Shale Program Presentation	April 1972	Vernal, Utah	Slide show and discussion of the proposed prototype oil shale program before the Kiwanis Club .
Rocky Mountain Oil & Gas Assn., Synthetic Fuels Div., Speech	April 1972	Billings, Mont.	Speech at mid-year meeting, presented the proposed prototype oil shale program with progress report on current oil shale activities.
Proposed Prototype Oil Shale Program Presentation	May 1972	Glenwood Springs, Colo.	Slide show and discussion of the proposed prototype oil shale program before the National Society of American Foresters.
Field Trip for the Public	May 1972	Wyoming Colorado Utah	Field tour for the public to inspect selected oil shale tracts W-a & W-b (Wyoming), C-a & C-b (Colorado) and U-a and U-b (Utah).
Secretary Oil Shale Briefing	June 1972	Denver, Colo.	Briefing for Secretary of Interior, Rogers C. B. Morton-News Release same date.
Thorne Ecological Institute Field Trip	June thru July 1972	Aspen, Colo. and surrounding areas, incl. Piceance Creek Basin	Sixth National Seminar on Environmental Arts & Sciences.

PURPOSE	DATE	PLACE	REMARKS
Field Trip for the Public	July 1972	Wyoming Colorado Utah	Field tour for the public to inspect selected oil shale tracts W-a, W-b (Wyoming), C-a, C-b (Colorado), and U-a, U-b (Utah)
	LONG TERM ACTIVITIES		
Denver Audubon Meetings	June 1971 to present	Denver, Colo.	Several Denver meetings during the period.
Oil Shale Regional Planning	June 1971 to present	Rifle, Colo.	Field trips to western slope areas, mainly Rifle, to attend about 15 meetings of the Oil Shale Regional Planning Commission
Colorado Open Space Council Meetings	June 1971 to present	Denver, Colo.	Several COSC meetings during the period.
State of Colorado Oil Shale Planning and Coordination Committee		Denver, Colo.	Environmental oil shale problems committee (State of Colorado) cooperative studies-multiple meetings
Oil Shale SLUP Applications	September thru Nov. 1971	Piceance Creek Basin, Uinta Basin	Multiple field trips to inspect SLUP applications prior to approval by multi-disciplined inspection group and agencies.
Oil Shale SLUP Drilling Monitoring and Inspection	October 1971 thru present	Piceance Creek Basin, Uinta Basin	Multiple field trips to examine and inspect oil shale core drilling permits, drilling activities, and procedures.

F. Review of the Draft Statement

The Draft Environmental Statement for the Proposed Prototype Oil Shale Leasing Program was released by the Department of the Interior on September 7, 1972. Notice of availability of the Draft Statement was published in the Federal Register, pages 18098-18099, Vol. 37, No. 174, Thursday, September 7, 1972. In that same location, a notice was also published announcing that public hearings on the Draft Statement were to be held the week of October 10-13, 1972 in the State capitols of the three States involved, Colorado, Wyoming, and Utah, and in three cities of these states near the proposed lease sites. The published notice announced that written comments would be received on the Draft Statement for a period of 45 days (October 22, 1972) after the publication of the notice. The deadline was later extended by the Secretary of the Interior to November 7, 1972, in response to comments received both in writing and at the public hearings requesting an extension in time.

Copies of the Draft Statement were sent to 18 Federal agencies, 5 State House agencies and 55 private organizations and comments were requested (Table I-1).

G. Plans for Future Coordination

Should a decision be reached to implement the proposed program, the Secretary of the Interior will issue an order establishing policies and procedures to be followed by the Department to effectuate the program. A proposed Secretarial Order is reproduced below.

United States Department of the Interior

OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20240

ORDER NO. (Proposed to be issued if a decision is reached to implement the proposed prototype oil shale leasing program.)

Subject: Prototype Oil Shale Leasing Program

Sec. 1 Purpose. This order prescribes policy and procedures for the prototype oil shale leasing program under the Mineral Leasing Act, as amended (30 U.S.C. §§ 181-263).

Sec. 2 Policy. The issuance of any prototype oil shale leases and the supervision of operations under such leases shall be conducted pursuant to the regular channels of authority in the Department. Secretarial Order 2948 establishes the respective fields of responsibility of the Bureau of Land Management and the Geological Survey. All oil shale leasing and supervision of lease operations shall be pursuant to Secretarial Order 2948 and the applicable regulations, specifically those in 43 CFR Part 23, 43 CFR Group 3000, and 30 CFR Part 231.

Sec. 3 Establishment of Technical Advisory Board. While ultimate responsibility for leasing and supervision of operations shall follow the existing channels of authority set up in Secretarial Order 2948 and the regulations cited above, the oil shale program is a venture into a new area in which many problems are still not solved and in which it is of vital importance that necessary safeguards be taken to protect the environment. Consequently, the Assistant Secretary--Land and Water Resources is directed to establish, after consultation with the Assistant Secretary--Energy and Minerals, an Oil Shale Technical Advisory Board to assist the responsible officers in the performance of their duties.

Sec. 4 Membership. The Oil Shale Technical Advisory Board will have its headquarters in Denver and will comprise members from the following departmental bureaus and offices: the Bureau of Land Management, the Geological Survey, the Bureau of Mines, the Bureau of Outdoor Recreation, the Bureau of Sport Fisheries and Wildlife, the National Park Service, the Bureau of Reclamation, the Bureau of Indian Affairs, and the Office of the Solicitor. The heads of the Executive Departments and the Administrator of the Environmental Protection Agency shall also be invited to appoint members to the Board. The governors of the States within the boundaries of which oil shale leases have been issued and any governments of local units within the boundaries of which leases have been issued will be

invited to designate representatives (including members of the general public) to be observers and to present their views to the Board when appropriate, although they will not be members of the Board. The chairman of the Technical Advisory Board and such clerical staff as may be needed will be appointed by the Assistant Secretary--Land and Water Resources, after consultation with the Assistant Secretary--Energy and Minerals.

Sec. 5 Functions. The functions of the Technical Advisory Board shall be advisory only, with particular responsibility to advise the district manager of the Bureau of Land Management and the mining supervisor of the Geological Survey in the exercise of their respective functions under the prototype oil shale leasing program. Although the functions of the Technical Advisory Board are purely advisory, the mining supervisor of the Geological Survey shall not approve exploratory or development plans under section 10 of a prototype lease, or significant amendments or revisions of, or supplements to, such plans, until he has submitted those plans, or amendments, revisions, or supplements, to the Technical Advisory Board and has given interested members an opportunity to comment on them. Similarly, the district manager of the Bureau of Land Management shall issue no special land use permit in connection with the prototype oil shale leasing program until he has submitted the application for that permit to the Technical Advisory Board and has given interested members an opportunity to comment on it. The mining supervisor shall not approve the detailed development plan under section 10 of a prototype lease without a public hearing on the environmental aspects of that plan. The mining supervisor and the district manager may hold such other hearings on actions in connection with the prototype oil shale program as they deem desirable. The Technical Advisory Board shall assist the mining supervisor or the district manager in conducting public hearings. The Technical Advisory Board shall prepare an annual report to the Secretary on the environmental aspects of the Prototype Oil Shale Leasing Program and on the status of exploration and development activities. This report will be made available to the public.

Sec. 6 Disputed Decisions. If any member of the Technical Advisory Board is dissatisfied with a decision of the Department's management or supervisory personnel with respect to an oil shale lease, he is expected to bring that matter first to the attention of the Board. The Technical Advisory Board will attempt to resolve all problems brought to its attention, but, if the Board is unable to do so, a dissatisfied member is expected to bring his objections to the attention of his own superior, and any matter may thus be brought to the attention of the Secretary of the Interior through the normal channels of authority as prescribed in 110 DM 1.11.

Sec. 7 Liaison Officer. The Assistant Secretary--Land and Water Resources, after consultation with the Assistant Secretary--Energy and Minerals, shall appoint a departmental employee stationed in Washington, D. C., to serve as the responsible liaison officer between the Technical Advisory Board and the Secretariat.

Sec. 8 Oil Shale Task Force. The present Oil Shale Task Force, established by the Assistant Secretary--Minerals and the Assistant Secretary--Public Land Management on January 16, 1970, shall be dissolved when this order becomes effective, as provided in section 9 below, and until that time it shall continue its present duties.

Sec. 9 Effective Date. This order will become effective on the day following the completion of the acceptance or rejection of all bids received for the six prototype leases offered.

Secretary of the Interior

Date:

Table I-1.--Groups Solicited for Comments on the Draft Environmental Statement

Federal agencies:

Environmental Protection Agency
Department of Commerce
Department of Transportation
Atomic Energy Commission
Federal Power Commission
Office of Emergency Preparedness
Department of Defense - Office of Naval Petroleum and Oil Shale Reserves
Department of Agriculture
Bureau of Sport Fisheries and Wildlife, Department of the Interior
National Park Service, Department of the Interior
Bureau of Outdoor Recreation, Department of the Interior
Geological Survey, Department of the Interior
Bureau of Mines, Department of the Interior
Office of Coal Research, Department of the Interior
Office of Oil and Gas, Department of the Interior
Bureau of Land Management, Department of the Interior
Bureau of Indian Affairs, Department of the Interior
Bureau of Reclamation, Department of the Interior

State agencies:

Colorado Department of Local Affairs
Utah State Planning Coordinator
Wyoming State Planning Coordinator
Oil Shale Regional Planning Commission (of Garfield, Mesa and Rio Blanco Counties, Colo.)
County Commissioners of Utah County and Wyoming County

Private organizations:

Natural Resources Defense Council
Rocky Mountain Center on Environment
University of Wisconsin, Glen D. Weaver
Colorado Open Space Council
Sierra Club
Wilderness Society
National Audubon Society
National Recreation and Park Association
Wildlife Management Institute
National Wildlife Federation
Izaac Walton League
Environmental Action
Friends of the Earth
Environmental Policy Center

Table I-1. (cont.).--Groups Solicited for Comments on the Draft Environmental Statement.

Private organizations (cont.):

Conservation Foundation
Nature Conservancy
American Forest Association
Center for Law and Social Policy
Environmental Defense Fund
Colorado Sportsmen's Association
Rocky Mountain Sportsmen's Federation
National Council of Public Land Users
Utah Wildlife Federation
Wyoming Open Space Council
American Petrofina Co. of Texas
Ashland Oil, Inc.
Barodynamics, Inc.
Occidental Petroleum Corp.
Garrett Research (Occidental Petroleum Corp.)
Geokinetics, Inc.
Gulf Minerals Resources Co.
Marathon Oil Co.
The Oil Shale Corp.
Phelps Dodge Corp.
Shell Oil Co.
SOHIO Petroleum Co.
The Superior Oil Co.
Cameron Engineers
Sun Oil Co.
Western Oil Shale Corp.
Mobil Oil Co.
Chevron Oil Co.
Equity Oil Co.
Cities Service Oil Co.
Carter Oil Co.
Union Oil Co.
Getty Oil Co.
Development Engineering
Denver Audubon Society
Thorne Ecological Institute
Colorado State Rehabilitation Sub-Committee
Denver Research Institute
Humble Oil and Refining Co.
AMOCO Production Co.
Bell Petroleum Co.
Atlantic-Richfield Co.

II. ANALYSIS OF PUBLIC COMMENTS

Public review of the September 1972 Draft Environmental Statement resulted in extensive participation by interested individuals and organized groups. In this chapter, a summary overview is presented of the types of comments received. In addition, it serves as a guide to discussions in the Final Environmental Statement which deals with the subjects raised in the comments. The subjects of the comments contained herein were reclassified and further sub-divided in Chapter III to enable an orderly narrative response to each topic. Thus, Chapter II is designed to introduce the reader to the review subject material while Chapter III contains a more detailed presentation of the comments and the Department of the Interior responses.

Written comments were received from 17 Federal agencies, I U.S. Congressman, 7 State agencies, 29 environmental-conservation groups, 25 private industrial companies, 123 private citizens, and 3 miscellaneous groups. These written comments totaled 1,939 pages, including 1,102 pages of appended materials. Reproduction of all letters received are contained in Volume V.

Testimony was received from 95 individuals at the public hearings held during the week of October 10-13, 1972. Transcripts of this testimony comprised 450 pages. Reproduction of the hearings transcripts are contained in Volume VI of this environmental statement. In addition to the oral testimony, material was submitted to the Director, Office of Hearings and Appeals, that totaled 388 pages. These materials were designated as "Exhibits" of the particular public hearing at which these were submitted. The supplemental testimony, the material appended with the written comments, and

other public documents (Chapter IV, Section C, this volume) are available for inspection by the public in the Office of the Oil Shale Coordinator, Department of the Interior, Washington, D. C. 20240.

The types of comments received are classified below into two categories: (a) general comments, and (b) comments on environmental matters. Each comment is footnoted and keyed to an appropriate reference in Comment Index List, Section C, of this chapter.

A. General Comments

A wide variety of opinions were offered by the reviewers. Many reviewers criticized the Draft Environmental Statement as being inadequate or not conforming to the National Environmental Policy Act,[1] while others generally approved of the Draft Statement.[2] Two major reviews were received on the June 1971 preliminary environmental statement. One of these respondents (39)[1/] found that the September (1972) draft statement still does not satisfy the requirements of the National Environmental Policy Act, while the other 42 stated that "... it will be extremely difficult for critics to contend with accuracy that the Draft Statement has 'ignored' significant environmental aspects..." The Department was criticized for alleged lack of sufficient public notice[3] and coordination with individual and State scientists,[4] the Colorado Division of Wildlife, the Wyoming Game and Fish Department,[5] and for the time of holding public hearings.[6] Comments were made concerning the preparation of a new Draft Environmental Statement,[7] and the decision-making process.[8] Accusations of a government-industry coalition or subsidization of private industry

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1/ References to individuals or groups may be found in Chapter IV, Sections A and B of this volume.

by government were made,[9] while one request was made for a government-industry prototype program as an alternative to the proposed action.[10]

A number of comments cited the need for a national energy policy.[11] One letter voiced a strong plea for energy conservation,[12] and another comment requested the government to encourage alternative transportation modes.[13] Two comments discussed the alternatives of offshore production.

Fourteen comments questioned the need to develop oil shale when the estimated production (1-million BPD) would supply only 4 percent of the Nation's 1985 energy needs.[15] One comment questioned that the U.S. was not facing an energy crisis but was instead faced with rapidly growing demand.[16] Statements that oil shale is not commercial[17] and is only a stopgap measure until the full use of nuclear energy is attained, were made.[18] A research institute stated that, "the development profile presented by Interior falls within the acceptable range of judgment based on national energy needs and the level of our technologic capability."[19] Numerous comments were received suggesting exploration of energy alternatives[20] and others cited the energy crisis and the need for oil shale development.[21]

Reviewers claimed a need for more planning and more studies,[22] and a need to take cognizance of several energy studies such as the Northern Great Plains Resource Program.[23] Questions were raised concerning the development of private oil shale lands first[24] and the Department's evaluation of the prototype program with respect to the possibility of declaring a moratorium on further leasing.[25]

Comments were received requesting that the Department establish: (a) a tract selection committee; (b) a lease form committee; and (c) a program review committee.[26] Also, it was requested that economic or cost-benefit analyses be made.[27]

Two comments suggested that oil shale development should not proceed until standards and regulations are passed by Congress, or, alternatively, the Department should prepare legislation and/or amend its own regulations to insure minimal environmental impacts.[28]

The balance of payments deficit[29] and the lack of generation of public revenues by oil imports[30] was cited. One company requested that the depletion allowance be increased and stated that the 5,120 acre lease limit was insufficient.[31]

It was claimed that the Department has dismissed in situ development.[32] Also, a group of companies, organized in a joint venture, criticized competitive bidding and cited the need for a role for small companies and in situ research.[33]

The extensive land requirements of oil shale development and the need for land-use planning was cited.[34, 35]

Questions were raised about who bears the cost for providing environmental repair.[36]

One engineering company offered answers to six questions concerning matters separately addressed in this volume: (a) private lands vs public lands; (b) joint study; (c) crash program; (d) tract alternatives; (e) salinity; and (f) curtailing development in the absence of solutions to environmental problems.[37]

A number of technologic comments were received. Fourteen comments were received emphasizing the prototype nature of the leasing program.[38] Eight other diverse technologic comments were received.[39 to 45]

Comment was received on the tract selection process,[46] the adequacy of consideration of alternatives to selected tracts,[47] and the question of why the particular six tracts were chosen.[48]

B. Comments on Environmental Matters

The impacts of industrial development were questioned.[49] Many of the respondents expressed concern about damage to the total ecology from the oil shale development.[50] Concern was expressed about waste disposal problems, particularly disposal of spent shale.[51] Revegetation and land reclamation were the subjects of other concerns,[52] and questions regarding vegetation[53] and the need for total ecological consideration were mentioned.[54]

Perhaps the matter of greatest concern to most of the reviewers was water.[55a] Questions concerning water quality, water resources, availability, depletion, domestic and industrial water use projections, potential damage to the Colorado River below Hoover Dam, and many others, were raised.[55b-r]

Air quality, meteorology, emissions, and air quality monitoring received extensive comment.[56]

The socioeconomic effects of the oil shale development were the subject of much comment,[57a-i] and much reference was made to social impacts due to the population increase expected in the oil shale regions if oil shale development takes place. Various questions

were asked, such as: What happens if there is a sudden shutdown of the industry? What about impacts on municipal water and sewage? What will be the need for increased health, medical, and dental services? and other questions.

Another area of major concern was addressed to the impact on wildlife in the oil shale regions.[58a] Many questions were raised concerning the interrelationship between wildlife and its environment, effects on fishing and hunting, consideration of several Federal and international treaties regarding wildlife, effect on wildlife due to increased populations, need for wildlife inventories, and others.[58b-m] Reviewers offered many questions and comments regarding mining operations.[59] Concerns were expressed, for example, about mining subsidence, mine safety, dust control, ventilation air, spoilage of strip mining, backfilling, and environmental analyses before mining.[59b-j]

Archaeological, esthetic and recreational values were concerns of other reviewers.[60a-e]

Numerous comments were received on the proposed lease and stipulations.[61a-x] Comments received were critical of: the powers of the Mining Supervisor, the lessee's monitoring program, the rental rate, the escrow bond, the bid order, and others.[61a-x]

Comments were also received on Indian Claims,[62] oil spills,[63] erosion,[64] and the need for more in-depth information regarding climate.[65]

C. Comment Index List

The section that follows list the categories and sub-categories of comments received during the review process. Listed under the headings are the reference numbers for the appropriate reviewer. A complete identification for the reference is given in Chapter IV of this volume. The letter or hearing transcript referred to is reproduced in Volumes V and VI.

1. Draft environmental statement inadequate

Comment Reference No.:[1/] (28) (30) (34) (36) (37) (38) (39) (40) (41) (44) (50) (81) (83) (85) (87) (98) (125) (160) (163) (165) (168) (179) (186) (198) (202) (207) (226) (241) (283)

2. General approval of draft environmental statement

Comment Reference No.: (3) (4) (11) (12) (13) (17) (42) (54) (57) (58) (59) (62) (68) (69) (72) (74) (200) (201) (208) (217) (225) (235) (256) (257) (272) (276) (286)

3. Sufficiency of public notice

Comment Reference No.: (140) (158) (161) (182) (195) (228) (290)

Discussion, Sec: Vol. IV, Chapt. III, Sec. K.1

4. Coordination with individual or State scientists

Comment Reference No.: (20) (30) (127) (168) (289)

Discussion, See: Vol. III, Chapter I, Sec. B

5. Coordination with Colorado Wildlife Division or the Wyoming Game and Fish Department

Comment Reference No.: (25) (79) (189) (220)

Discussion, See: Vol. I, Chapt. II, Sec. C.8 and D.6
Vol. III, Chapt. I, Sec. B
Vol. IV, Chapt. E.5

6. Method of holding public hearings

Comment Reference No.: (83)

Discussion, See: Vol. IV, Chapt. III, Sec. K.1

1/ Reference to individuals or groups may be found in Chapter IV, Sections A and B of this volume.

7. Requests for submission of new draft environmental statement

Comment Reference No.: (33)(39)

Discussion, See: Vol. IV, Chapt. III, Sec. K.4

8. Decision making process

Comment Reference No.: (7)(38)(39)

Discussion, See: Vol. III, Chapt. IX

9. Assertion of government-industry coalition

Comment Reference No.: (49)(145)

Discussion, See: Vol. IV, Chapt. III, Sec. J.50

10. Request for government-industry prototype program

Comment Reference No.: (38)

Discussion, See: Vol. III, Chapt. IX, Sec. C

11. Need for a National Energy Policy

Comment Reference No.: (7)(7a)(18)(30)(38)(41)(83)(146)(153)(202)(229)(233)(241)(245)(247)(269)

Discussion, See: Vol. IV, Chapt. III, Sec. I.11

12. Energy conservation

Comment Reference No.: (33)

Discussion, See: Vol. II, Chapt. V, Sec. A

13. Government should encourage alternative transportation modes

Comment Reference No.: (202)

Discussion, See: Vol. II, Chapt. V, Sec. A

14. Alternatives of offshore production

Comment Reference No.: (62)(66)

Discussion, See: Vol. II, Chapt. V, Sec. B

15. Shale oil will supply only 4 percent of energy needs by 1985

Comment Reference No.: (18)(28)(83)(94)(118)(129)(136)(158)(171)(173)(199)(202)(215)(230)

Discussion, See: Vol. IV, Chapt. III, Sec. I.19

16. U.S. not facing an energy crisis--instead faced with rapidly growing demand

Comment Reference No.: (215)

Discussion, See: Vol. II, Chapt I, Sec. A

17. Oil shale is not commercial

Comment Reference No.: (117)(136)(153)(155)

Discussion, See: Vol. I, Chapt. III, Sec. A

18. Oil shale only a stopgap until full development of nuclear energy

Comment Reference No.: (123)(136)

Discussion, See: Vol. II, Chapt. V, Sec. B

19. Oil shale development within acceptable range of judgment

Comment Reference No.: (24)

Discussion, See: Vol. IV, Chapt. III, Sec. A.15

20. Explore alternative energy sources

Comment Reference No.: (2)(7)(7a)(18)(22)(23)(30)(36)(38)(39)(41)(42)(44)(45)(89)(99)(106)(117)(121)(129)(153)(155)(173)(184)(188)(193)(202)(204)(214)(222)(228)(230)(269)

Discussion, See: Vol. II
Vol. IV, Chapt. III, Sec. I

21. Energy crisis and need for oil shale development

Comment Reference No.: (7a) (11) (21) (53) (54) (55) (57) (64) (68) (69) (70) (71) (72) (73) (75) (200) (203) (210) (213) (235) (253) (254) (256) (261) (262) (271) (272) (273) (278) (279) (284) (290)

Discussion, See: Vol. IV, Chapt. III, Sec. I.13

22. Need for more studies and planning

Comment Reference No.: (5) (23) (26) (29) (33) (36) (38) (39) (40) (42) (45) (51) (72) (77) (82) (86) (93) (97) (127) (130) (134) (139) (142) (144) (146) (147) (150) (151) (154) (166) (174) (175) (181) (183) (188) (189) (191) (202) (205) (215) (220) (224) (269)

Discussion, See: Vol. IV, Chapt. III, Secs. I.12 and I.20

23. Other resource studies (i.e., Northern Great Plains Resource Program)

Comment Reference No.: (7) (39)

Discussion, See: Vol. IV, Chapt. III, Sec. I.10

24. Develop private oil shale lands first

Comment Reference No.: (7) (23) (30) (32) (39) (42) (51) (102) (127) (136) (185) (207) (221) (222) (285) (293)

Discussion, See: Vol. III, Chapt. IX, Sec. E

25. Evaluation of prototype program, including possibility of moratorium on further leasing

Comment Reference No.: (7)

Discussion, See: Vol. IV, Chapt. III, Sec. K.2

26. Department should establish tract selection, lease form, and program review committees

Comment Reference No.: (30) (38) (39)

Discussion, See: Vol. IV, Chapt. III, Secs. J.29 and J.47

27. Requests for economic or cost-benefit analysis

Comment Reference No.: (6)(38)(39)(50)

Discussion, See: Vol. IV, Chapt. III, Sec. K.3

28. Wait for new standards or regulations

Comment Reference No.: (18)(39)

Discussion, See: Vol. IV, Chapt. III, Sec. J.32

29. The balance of payments deficit

Comment Reference No.: (11)(210)(235)(276)

Discussion, See: Vol. II, Chapts. I, II, III and IV

30. Reliance on foreign sources of oil does not generate public revenues at the Federal level

Comment Reference No.: (24)

Discussion, See: Vol. IV, Chapt. III, Sec. H.18

31. Depletion allowance should be increased and present 5,120 acre limit for leasing is not sufficient

Comment Reference No.: (72)

Discussion, See: Vol. IV, Chapt. III, Secs. J.1 and J.4

32. Claims that Department has dismissed in situ processing

Comment Reference No.: (209)(266)

Discussion, See: Vol. I, Chapt. III, Sec. B.1.c
Vol. III, Chapt. III, Sec. B, and Sec. C.3

33. Company joint venture comment: competitive bidding, role of small companies, in situ research

Comment Reference No.: (21)(53)(55)(60)(61)(63)(65)(71)(76)(209)(238)(266)

Discussion, See: Vol. IV, Chapt. III, Sec. J.48

34. Land requirements--land use planning

Comment Reference No.: (36) (38) (39) (45) (136) (222) (223)

Discussion, See: Vol. IV, Chapt. III, Sec. H.19

35. Need for land use planning and control

Comment Reference No.: (7) (36) (42) (44) (52)

Discussion, See: Vol. IV, Chapt. III, Sec. H.19

36. Cost for providing environmental repair

Comment Reference No.: (18) (30) (36) (50) (79)

Discussion, See: Vol. III, Chapt. I, Sec. C.5

37. Engineering company answers to six common questions regarding oil shale development

Comment Reference No.: (57)

Discussion, See: Vol. IV, Chapt. III, Secs. I.26, I.12, I.13, I.17, B.2, I.20

38. Prototype nature of the leasing program

Comment Reference No.: (21) (24) (54) (59) (64) (70) (73) (74) (254) (256) (275) (276) (278) (279)

Discussion, See: Vol. III, Chapt. I

39. Discussion of oil shale economics and length of time to develop Athabasca Tar Sands

Comment Reference No.: (73)

Discussion, See: Vol. III, Chapt. III, Sec. A
Vol. III, Chapt. IX, Sec. E
Vol. IV, Chapt. III, Sec. I

40. Comment asserting reluctance to answer questions on hazards of in situ processing

Comment Reference No.: (50)

Discussion, See: Vol. I, Chapt. III
Vol. III, Chapt. IV

41. Need for more detailed treatment of coal gasification and liquefaction

Comment Reference No.: (10)

Discussion, See: Vol. II, Chapt. V, Sec. B.5
Vol. IV, Chapt. III, Sec. I.1

42. Co-development of nahcolite-dawsonite

Comment Reference No.: (13)(74)(207)(225)

Discussion, See: Vol. IV, Chapt. III, Secs. A.7, A.8

43. Conflict with nuclear stimulation of natural gas

Comment Reference No.: (19)(67)(206)(212)(293)

Discussion, See: Vol. I, Chapt. II, Sec. A.4.c
Vol. IV, Chapt. III, Sec. I.8

44. How are sodium-rich salt beds handled?

Comment Reference No.: (22)

Discussion, See: Vol. IV, Chapt. III, Sec. A.8

45. Why not a "waterless development?"

Comment Reference No.: (32)

Discussion, See: Vol. IV, Chapt. III, Sec. A.5

46. Tract selection process

Comment Reference No.: (33)(38)(39)(42)

Discussion, See: Vol. III, Chapt. IX, Sec. H

47. Adequacy of consideration of alternatives to selected tracts

Comment Reference No.: (103)

Discussion, See: Vol. III, Chapt. IX, Sec. H

48. Why were the particular 6 tracts chosen?

Comment Reference No.: (33) (36) (39) (42) (44)

Discussion, See: Vol. III, Chapt. IX, Sec. H

49. Effects of industrial development

a. Effects of a mature industry

Comment Reference No.: (2) (9) (28) (33) (36) (39) (42) (45) (47) (52) (95) (163) (231) (233)

Discussion, See: Vol. III, Chapt. III
Vol. IV, Chapt. III, Sec. H.12

b. Triggering of related or peripheral industrial developments

Comment Reference No.: (42)

Discussion, See: Vol. I, Chapt. III, Sec. C.1.a.8

c. Effects of oil shale development on areas outside the actual development

Comment Reference No.: (7) (23) (33) (38) (42) (44) (45) (52)

Discussion, See: Vol. I, Chapt. III

d. What about the period after oil shale development?

Comment Reference No.: (30) (32) (41) (95) (114) (162) (163) (231) (295)

Discussion, See: Vol. IV, Chapt. III, Sec. H.13

e. Need for safeguards to shut down operations if determined to be environmentally unacceptable

Comment Reference No.: (7) (83) (214) (231) (247)

Discussion, See: Vol. IV, Chapt, III, Sec. I.20

50. Damage to total ecology (general)

Comment Reference No.: (43) (46) (77) (78) (83) (88) (90) (94) (102) (104) (113) (117) (123) (126) (131) (138) (139) (144) (149) (150) (152) (155) (167) (173) (177) (181) (182) (185) (186) (193) (196) (199) (291)

Discussion, See:
Vol. I, Chapt. III, Table III-1, Sec. B.4
Vol. I, Chapt. III, Sec. E
Vol. III, Chapt. IV, Sec. E
Vol. IV, Chapt. III, Sec. E

51. Waste disposal, particularly spent shale

Comment Reference No.: (6) (7) (13) (19) (23) (26) (38) (39) (49) (51) (68) (77) (78) (86) (114) (117) (118) (120) (136) (142) (146) (154) (158) (178) (191) (211) (224) (268) (283)

Discussion, See:
Vol. I, Chapt. I, Sec. C.1.d(2); Sec. D.3; Sec. D.5.a
Vol. I, Chapt. III, Sec. C.5.9
Vol. III, Chapt. II, Sec. B.1.e; Sec. B.2.e; Sec. B-3.e
Vol. III, Chapt. IV, Sec. A.1.a; Sec. A.2.a; Sec. A.2.b; Sec. A.2.c; Sec. A.3.a; Sec. A.3.b; Sec. A.4.a; Sec. A.4.b

52. Revegetation--land reclamation

Comment Reference No.: (2) (5) (7) (8) (26) (36) (39) (42) (43) (44) (50) (83) (86) (114) (137) (168) (217) (218) (222) (270) (283) (290) (295)

Discussion, See:
Vol. I, Chapt. I, Sec. D
Vol. I, Chapt. IV, Sec. A
Vol. III, Chapt. IV, Sec. A

53. Vegetation

Comment Reference No.: (2) (12) (38) (154) (165) (166) (218)

Discussion, See: Vol. I, Chapt. II, Sec. A.8;
Sec. B.8;
Sec. C.8;
Sec. D.8
Vol. I, Chapt. III, Sec. B.4
Vol. III, Chapt. II, Sec. B.1.f;
Sec. B.2.f;
Sec. B.3.f;
Sec. B.4.f

54. Need for total ecological consideration

Comment Reference No.: (38)

Discussion, See: Vol. I, Chapt. I, Sec. D.4
Vol. I, Chapt. II, Sec. A.6 to A.8;
Sec. B.6 to B.8;
Sec. C.6 to C.8;
Sec. D.6 to D.8
Also see Comment 50 above.

55. Water

a. General--quality, salinity, etc.

Comment Reference No.: (5) (7) (18) (19) (20) (28) (36) (38) (39)
(40) (42) (43) (44) (47) (49) (51) (78) (83)
(88) (95) (114) (117) (120) (127) (136) (137)
(142) (145) (146) (153) (155) (158) (166)
(178) (191) (202) (211) (217) (222) (225)
(228) (280) (283) (285) (287) (295)

Discussion, See: Vol. I, Chapt. I, Sec. D.7
Vol. I, Chapt. II, Sec. A.5
Vol. I, Chapt. III, Sec. C
Vol. I, Chapt IV, Sec. C
Vol. I, Chapt. V, Sec. C
Vol. I, Chapt. VI, Sec. C
Vol. III, Chapt. IV, Sec. C
Vol. IV, Chapt. III, Sec. B.2

b. Water resources--availability

Comment Reference No.: (2)(7)(20)(22)(28)(39)(47)(202)(258)(270)(272)(282)

Discussion, See: Vol. I, Chapt. II, Sec. C
Vol. IV, Chapt. III, Sec. B.1

c. Depletion of ground water, surface water, and maintenance of quality

Comment Reference No.: (6)(13)(33)(39)(50)

Discussion, See: Vol. I, Chapt. II, Sec. A.5.a;
Sec. A.5.b;
Sec. B.5;
Sec. C.5
Sec. D.5 and D.7
Vol. I, Chapt. III, Sec. C
Vol. IV, Chapt. III, Secs. B and C

d. Water use projections--combined domestic and industrial

Comment Reference No.: (39)(163)

Discussion, See: Vol. I, Chapt. III, Sec. C.1.a(7)
Vol. III, Chapt. IV, Sec. C

e. Potential damage to Colorado River below Hoover Dam

Comment Reference No.: (7)(18)(19)(28)(33)(43)(155)(282)

Discussion, See: Vol. I, Chapt. II, Sec. A.5.a
Vol. IV, Chapt. III, Sec. B.2

f. Water use by increased populations

Comment Reference No.: (16)(28)(36)(39)(137)(163)(191)(223)(241)

Discussion, See: Vol. I, Chapt. III, Sec. C.1.a
Vol. IV, Chapt. III, Sec. B.3

g. Salinity detriments--Lower Colorado River Basin

Comment Reference No.: (22)(32)(42)(50)

Discussion, See: Vol. I, Chapt. II, Sec. A.5,
Sec. C.4.a
Vol. I, Chapt. III, Sec. C.4.b

h. Dams and power plants

Comment Reference No.: (7) (13) (39) (85) (136) (137) (142) (163) (178) (247)

Discussion, See: Vol. I, Chapt. II, Sec. A.5
Vol. I, Chapt. III, Sec. C.1.a(5)
Vol. IV, Chapt. III, Sec. B.8

i. Water requirements--revegetation

Comment Reference No.: (36) (47) (79)

Discussion, See: Vol. I, Chapt. III, Sec. C.1.a(6)
Vol. III, Chapt. IV, Sec. B

j. Management of waste water and downstream impact

Comment Reference No.: (38)

Discussion, See: Vol. I, Chapt. II, Sec. A.5
Vol. I, Chapt. III, Sec.6

k. Leaching of spent shale

Comment Reference No.: (7) (13) (19) (20) (23) (39) (50)

Discussion, See: Vol. I, Chapt. III, Sec. C.5.a;
Sec. C.5.b
Vol. IV, Chapt. III, Secs. B.11, B.12, C.7

l. Water diversion

Comment Reference No.: (42)

Discussion, See: Vol. I, Chapt. II, Sec. A.5
Vol. I, Chapt. III, Sec. B.1

m. Pond evaporation and disposal

Comment Reference No.: (19) (50)

Discussion, See: Vol. I, Chapt. III, Sec. C.5.b

n. Subsurface injection

Comment Reference No.: (47) (50)

Discussion, See: Vol. I, Chapt. III, Sec. C.7

o. Basic water needs for the oil shale industry

Comment Reference No.: (7)

Discussion, See: Vol. I, Chapt. III, Sec. C.1.a(8)

p. Determination of quality of water that can be best used for various purposes

Comment Reference No.: (47)

Discussion, See: Vol. I, Chapt. III, Sec. C.1

q. Final Environmental Statement should indicate how oil shale development affects water availability and requirements

Comment Reference No.: (7)

Discussion, See: Vol. IV, Chapt. III, Sec. B.1, B.8

r. Water monitoring as part of slurry-pipeline-mining operation (Black Mesa, Arizona)

Comment Reference No.: (1)

Discussion, See: Vol. IV, Chapt. III, Sec. A.14

56. Air Quality

Comment Reference No.: (2) (7) (14) (19) (29) (32) (42) (44) (50) (78) (85) (127) (136) (137) (166) (168) (196) (202) (211) (222) (226) (228) (229) (258) (280) (281) (288) (289)

Discussion, See:
Vol. I, Chapt. I, Sec. D.5
Vol. I, Chapt. I, Sec. D.7
Vol. I, Chapt. III, Sec. D
Vol. I, Chapt. IV
Vol. I, Chapt. V, Sec. D
Vol. I, Chapt. VI, Sec. D
Vol. III, Chapt. IV, Sec. C
Vol. IV, Chapt. III, Sec. D

57. Socioeconomic effects

a. General

Comment Reference No.: (5) (7) (16) (41) (95) (162) (163) (166) (202) (217) (231) (233) (277) (281) (284) (294)

Discussion, See:
Vol. I, Chapt. II, Sec. A.11; Sec. B.11; Sec. C.10; Sec. D.10
Vol. I, Chapt. III, Sec. H
Vol. I, Chapt. V, Sec. H
Vol. I, Chapt. VI, Sec. H
Vol. III, Chapt. II, Sec. B.1.h; Sec. B.2.k; Sec. B.3.k; Sec. B.4.k
Vol. III, Chapt. IV, Sec. D; Sec. G
Vol. III, Chapt. VI
Vol. IV, Chapt. III, Sec. H

b. Population increase--schools, taxes, capital expenditures, etc.

Comment Reference No.: (2) (14) (16) (23) (39) (41) (42) (44) (49) (78) (85) (95) (122) (136) (137) (154) (155) (163) (181) (201) (212) (223) (268) (280) (281) (290) (291)

Discussion, See:
Vol. I, Chapt. III, Sec. H.1.b; Sec. H.2; Sec. H.3; Sec. H.4
Vol. IV, Chapt. III, Secs. H.2, H.3, H.7, H.8 H.9, H.10 H.12, H.21

c. Impacts of possible sudden shutdown

Comment Reference No.: (30) (41) (95) (114) (163)

Discussion, See: Vol. IV, Chapt. III, Sec. H.13

d. Health, medical, and dental service

Comment Reference No.: (27)(292)

Discussion, See: Vol. I, Chapt. III, Sec. H
Vol. IV, Chapt. III, Sec. H.14

e. Population growth controls for regions--particularly Colorado

Comment Reference No.: (163)

Discussion, See: Vol. IV, Chapt. III, Sec. H.3; Sec. H.4

f. Population increase and land devoted to agriculture

Comment Reference No.: (163)

Discussion, See: Vol. IV, Chapt. III, Sec. H.5

g. Possibility of land speculation

Comment Reference No.: (41)(233)

Discussion, See: Vol. IV, Chapt. III, Sec. H.5

h. Impacts on municipal water and sewage

Comment Reference No.: (7)(27)(47)(202)

Discussion, See: Vol. I, Chapt. III, Sec. H.1.d

i. Potential for influx of people into area looking for work who are not qualified

Comment Reference No.: (41)(233)

Discussion, See: Vol. IV, Chapt. III, Sec. H.7

58. Wildlife

a. General

Comment Reference No.: (Form letter, See 80)(23)(26)(39)(40)(42)(43)(48)(52)(86)(87)(120)(122)(127)(131)(154)(160)(162)(165)(166)(167)(179)(189)(205)(220)(236)(250)(267)(270)(283)(290)

Discussion, See: Vol. I, Chapt. II, Sec. A.6;
Sec. B-6;
Sec. C.6;
Sec. D.6
Vol. I, Chapt. III, Sec. E
Vol. I, Chapt. V. Sec. E
Vol. I, Chapt. VI, Sec. E
Vol. III, Chapt. II, Sec. B
Vol. III, Chapt. IV, Sec. D
Vol. III, Chapt. VI
Vol. III, Chapt. VIII
Vol. IV, Chapt. III, Sec. E.

b. Need for a detailed wildlife analysis

Comment Reference No.: (38) (79) (138) (159) (160) (189) (202) (242)

Discussion, See: Vol. I, Chapt. II, Sec. A.6;
Sec. B.6;
Sec. C.6;
Sec. D.6
Vol. IV, Chapt. III, Sec. E.4

c. Need for a wildlife inventory and inventory of fishable waters

Comment Reference No.: (2) (23) (47) (189) (202)

Discussion, See: Vol. I, Chapt. II, Sec. A.6;
Sec. B.6;
Sec. C.6
Vol. IV, Chapt. III, Sec. E.4

d. Need for data on fish populations

Comment Reference No.: (25) (32) (42) (44) (47) (246)

Discussion, See: Vol. I, Chapt. II, Table II-12 and II-13

e. Effects on wildlife due to increased populations

Comment Reference No.: (23)(39)(42)(44)

Discussion, See: Vol. I, Chapt. III, Sec. E.3.a
Vol. IV, Chapt. III, Sec. E.2

f. Rare and endangered species

Comment Reference No.: (6)(13)(32)(38)(138)(198)(268)

Discussion, See: Vol. I, Chapt. II, Sec. A.6;
Sec. B.6.e;
Sec. D.6.2
Vol. I, Chapt. III, Sec. E.2.h;
Sec. E.3.c
Vol. IV, Chapt. III, Sec. E.7, J.46

g. Effects on wildlife browse--cattle forage

Comment Reference No.: (7)(38)(42)(44)

Discussion, See: Vol. I, Chapt. II, Sec. B.6.b
Vol. I, Chapt. V, Sec. F
Vol. III, Chapt. IV, Sec. E
Vol. III, Chapt. VI
Vol. IV, Chapt. III, Secs. E.12, E.13
E.14, F.1

h. Increased pressures on fish and wildlife by increased roads and access

Comment Reference No.: (47)

Discussion, See: Vol. I, Chapt. III, Sec. E
Vol. I, Chapt IV, Sec. E
Vol. IV, Chapt. III, Secs. E.2, E.20

i. Restoration of wildlife habitat

Comment Reference No.: (50)

Discussion, See: Vol. III, Chapt V
Vol. IV, Chapt. III, Sec. E.13;
Sec. E.14

j. Hunting-fishing regulations, habitat, contribution to economy, loss of habitat

Comment Reference No.: (2)(25)(79)(189)(283)

Discussion, See: Vol. I, Chapt. II, Sec. B.6.b
Vol. IV, Chapt. III, Secs. E.9, E.10,
H.11

k. Water development projects and their effect upon wildlife

Comment Reference No.: (23)

Discussion, See: Vol. IV, Chapt. III, Sec. E.28

l. Interrelationship between wildlife and its environment

Comment Reference No.: (7)(23)

Discussion, See: Vol. I, Chapt. II, Sec. A.6; Sec. B.8
Vol. IV, Chapt. III, Sec. E.1, E.3, E.26

m. Consideration of five Federal and two international treaties

Comment Reference No.: (38)

Discussion, See: Vol. IV, Chapt. III, Sec. E.23

59. Mining

a. General

Comment Reference No.: (2)(136)(145)(154)(237)

Discussion, See: Vol. I, Chapt. III, Sec. C.2.a; Sec. C.3.a
Vol. III, Chapt. III, Chapt. V

b. Health hazards

Comment Reference No.: (31)(42)(44)(78)

Discussion, See: Vol. I, Chapt. III, Sec. H

c. Mine safety

Comment Reference No.: (31)(42)(137)(211)

Discussion, See: Vol. IV, Chapt. III, Sec. H.15; Sec. H.16

d. Mine ventilation air as a source of air pollution

Comment Reference No.: (7)

Discussion, See: Vol. I, Chapt. III, Sec. D.1.d; Sec. D.3.a

e. Disposal of saline mine drainage and water from mining operations

Comment Reference No.: (28)(42)(47)(50)

Discussion, See: Vol. I, Chapt. III, Sec. C.2.a

f. Mining subsidence

Comment Reference No.: (13)(39)(42)

Discussion, See: Vol. I, Chapt. III, Sec. A
Vol. III, Chapt. IV, Sec. A

g. Mining dust control, ventilation, roof control

Comment Reference No.: (19)(31)

Discussion, See: Vol. I, Chapt. III, Sec. D.1.b

h. Consider consequence of not back-filling open pit

Comment Reference No.: (68)

Discussion, See: Vol. IV, Chapt. III, Sec. A.2

i. Prepare further environmental analyses before mining. Department of the Interior official should confer with Regional administrator of EPA

Comment Reference No.: (7)

Discussion, See: Vol. IV, Chapt. J.15, J.29

j. Strip mine damage

Comment Reference No.: (106)(176)

Discussion, See: Vol. I, Chapt. III, Sec. A
Vol. III, Chapt. IV, Sec A

60. Esthetic and Recreational

a. General

Comment Reference No.: (Form letter, see #80)(2)(5)(25)(39)(43)(222)

Discussion, See: Vol. I, Chapt. II, Sec. A.9;
Sec. B.9;
Sec. C.9;
Sec. D.9
Vol. I, Chapt. III, Sec. G
Vol. I, Chapt. VI, Sec. G
Vol. III, Chapt. II, Sec. B.1;
Sec. B.2
Sec. B.3
Sec. B.4
Vol. III, Chapt. IV, Sec. F

b. Undeveloped areas--wilderness (Flattops) (South Fork of White River)

Comment Reference No.: (Form letter, see #80)(26)(39)(52)(122)(145)(185)(196)(227)(241)(282)

Discussion, See: Vol. IV, Chapt. III, Sec. G.6

c. Impact on caves

Comment Reference No.: 241)

Discussion, See: Vol. I, Chapt. II, Sec. B.9

d. Two potential National historical sites in Rio Blanco County

Comment Reference No.: (23)

Discussion, See Vol. IV, Chapt. III, Sec. G.7

e. Request for archaeological survey

Comment Reference No.: (140)

Discussion, See: Vol. I, Chapt. II, Sec. B.10;
Sec. C.11

f. Unknown historical and archaeological values

Comment Reference No.: (42)(289)

Discussion, See: Vol. I, Chapt. II, Sec. B.10;
Sec. C.11
Vol. I, Chapt. V, Sec. G
Vol. III, Chapt. VII
Vol. IV, Chapt. III, Sec. J.13, J.24

61. Lease and Stipulations

a. Discretion of mining supervisor

Comment Reference No.: (2) (23) (30) (32) (33) (42) (44) (145) (247) (285)

Discussion, See: Vol. IV, Chapt. III, Sec. J.35

b. Lessee's monitoring program

Comment Reference No.: (30) (36) (42) (44)

Discussion, See: Vol. IV, Chapt. III, Sec. J.37

c. Rental rate

Comment Reference No.: (18) (49) (136) (153) (158) (168) (178) (191)

Discussion, See: Vol. IV, Chapt. III, Sec. J.6

d. Escrow bond

Comment Reference No.: (18) (39) (180) (220)

Discussion, See: Vol. III, Chapt. I, Sec. 4
Vol. III, Chapt. V

e. Environmental base-line data needed

Comment Reference No.: (7) (47) (59) (202)

Discussion, See: Vol. IV, Chapt. III, Sec. J.26

f. Need for overseer committee to approve plans

Comment Reference No.: (267)

Discussion, See: Vol. IV, Chapt. III, Sec. J.29
Sec. J.47

g. Future role of field oil shale task force

Comment Reference No.: (7)

Discussion, See: Vol. IV, Chapt.I, Sec. G

h. Bid order

Comment Reference No.: (33)(38)(53)(177)

Discussion, See: Vol. IV, Chapt. III, Sec. J. 2

i. Lessee's obligation to observe stipulations

Comment Reference No.: (30)(39)

Discussion, See Vol. IV, Chapt. III, Secs. J.16, J.33

j. Provisions for follow-up on vegetation

Comment Reference No.: (8)

Discussion, See: Vol. III, Chapt. V

k. Additional royalties--minerals other than oil shale

Comment Reference No.: (1)

Discussion, See: Vol. IV, Chapt. III, Sec. J.8

l. Royalties should be increased

Comment Reference No.: (249)

Discussion, See: Vol. IV, Chapt. III, Sec. J.7

m. Lease and stipulations should be redrafted to protect both the land and the public interest

Comment Reference No.: (18)(39)

Discussion, See: Vol. III, Chapt. V

n. Lease weak--giveaway of public domain

Comment Reference No. (18)

Discussion, See: Vol. IV, Chapt. III, Sec. J.49

o. Need mechanism for quality reclamation of public lands

Comment Reference No.: (30)(36)

Discussion, See: Vol. III, Chapt. V

p. No mention made of dams and conduits to control flooding

Comment Reference No.: (8)

Discussion, See: Vol. III, Chapt. V

q. Stipulations do not adequately state that lessee is responsible for providing his own water

Comment Reference No.: (8)

Discussion, See: Vol. III, Chapt. V

r. 1965 Freedom of Information Statement should be included in lease form

Comment Reference No.: (38)

Discussion, See: Vol. III, Chapt. V

s. Stipulations should be modified to take into account that it may not be possible to revegetate steep pip slopes

Comment Reference No.: (68)

Discussion, See Vol. III, Chapt. V

t. Stipulations should specify return of spent shale underground

Comment Reference No.: (32)

Discussion, See: Vol. III, Chapt. V
Vol. IV, Chapt. III, Sec. J.31

u. Stipulations--indefiniteness of requirements.

Comment Reference No.: (30)(39)(68)

Discussion, See: Vol. IV, Chapt. III, Sec. J.36

v. The lease and stipulations are workable

Comment Reference No.: (70)

Discussion, See: Vol. III, Chapt. V

w. Twenty-year lease is too long (as with coal)

Comment Reference No.: (36)

Discussion, See: Vol. IV. Chapt. III, Sec. J.9

x. General approval of lease form

Comment Reference No.: (69)

Discussion, See: Vol. III, Chapt. V

62. Indian claims

Comment Reference No.: (1)(30)

Discussion, See: Vol. IV, Chapt. III, Sec. K.6

63. Oil spills

Comment Reference No.: (7)(8)

Discussion, See: Vol. I, Chapt. I, Sec. D
Vol. II
Vol. IV, Chapt. III, Sec. J.25

64. Erosion

Comment Reference No.: (36)(42)(43)(44)(50)

Discussion, See: Vol. I, Chapt. I, Sec. D.1;
Sec. D.5.e
Vol. I, Chapt. II, Sec. B.7;
Sec. C.7;
Sec. D.7

65. More data on climate needed

Comment Reference No.: (19)(42)(44)

Discussion, See: Vol. I, Chapt. II, Sec. A.2;
Sec. B.2;
Sec. C.2;
Sec. D.2
Vol. III, Chapt. II, Sec. B.1.b;
Sec. B.2.b;
Sec. B.3.b;
Sec. B.4.b

III. DISCUSSION OF POINTS RAISED DURING REVIEW AND PUBLIC HEARING PROCESS

During the review process, extensive comments were received covering the same broad topic, such as oil shale technology, surface water, etc. The comments dealing with these major categories were grouped according to more discrete subtopics. This chapter contains a general discussion of each major topic, the subtopics, a reference to the person or group making the comment, and a response to the comments as grouped within each subtopic. Where appropriate, sections of the Final Environmental Statement, which further amplify the responses, are referenced.

See Chapter IV, Sections A, B and C, of this Volume for a listing of the comments received and their reference number.

A. Oil Shale Technology

Two methods of extraction will probably be considered for oil shale development: (1) mining the oil shale by surface (open pit) or underground methods and processing the oil shale and shale oil in surface plants; and (2) in situ or in-ground extraction methods. Comments pertaining to various technical aspects of oil shale development are considered below. Detailed discussion of oil shale technology is discussed in Volume I, Chapter I, Section C, and Volume II, Chapter III.

1. Environmental Impact Statements

Environmental impact statements should be written and public hearings held on each mining plan that is filed after lease awards (2).

Response

The proposed lease stipulations have been amended to require that additional environmental studies be conducted for at least 2 years on each tract to establish additional base line data. At least one year of base line data must be collected prior to the submittal of a detailed development program to the mining supervisor. This program will be reviewed by the mining supervisor with assistance from the Technical Advisory Board, other Government agencies, and others with recognized expertise in the various disciplines involved (See, for example, proposed organization in Chapter I, Section G). At this time, it is not planned to prepare new environmental statements on each mining plan. No operations will begin on any tract until a development program that fully

meets all environmental criteria, controls, and constraints has been finally approved by the mining supervisor acting for the Secretary.

2. Backfilling; Surface Mine

Two comments questioned when backfilling of a surface mine should begin, how it should be conducted, and to what extent the pit may be filled after cessation of mining. It was also pointed out that consideration should be given to not backfilling (38, 68, 73).

Response

Extensive engineering, and geologic, and hydrologic studies will be required before any decision can be made as to when backfilling of an open pit mine on any tract can begin or the exact methods to be used. In the Final Environmental Statement surface mining, both with and without backfilling, has been evaluated in Volume I, Chapter III, and Volume III, Chapters III and IV. The tonnages and time schedule discussed in the Final Statement are for a hypothetical mine and should only be considered illustrative rather than precise. Not all of the overburden or processed shale can be backfilled into the mined-out portions of the pit and some portion must be disposed of on the surface. However, under provisions of the prototype leasing program, procedures for restoration of mined areas must be detailed in the development plans and these plans will be subject to public review before development actually begins.

3. Backfilling; Underground Mine

The lack of a lease stipulation requiring backfilling of underground mine openings with processed shale was questioned (32).

Response

It is premature to specify at this time that underground mine openings must be backfilled with spent shale. This approach to minimizing permanent surface change appears to be promising as judged from conceptual studies and by results of experienced in other mining operations. However, shale mine backfilling operations have not been actually demonstrated, even on a small scale. Thus, it cannot yet be concluded that underground mine backfilling is the optimum manner of waste disposal. The lease requires the lessee to submit a preliminary development program that must be approved and then a detailed development program on or before the third anniversary of the issuance of the lease as discussed in the response above. At the time of the submission of those plans, it will be appropriate to decide whether such specific procedures as backfilling should be required.

4. In Situ Development

In situ development should be favored over surface processing for the deep, rich oil shale beds (71).

Response

Although laboratory and field scale experimentation on in situ extraction has been conducted sporadically over the past two decades by the Bureau of Mines and by industry, including some experiments that are currently under way, no commercially feasible in situ

extraction technology has been demonstrated (Volume I, Chapter I, Section C.2.). Although this technique would result in less surface disturbance, in situ processing itself involves major environmental uncertainties, particularly concerning subsurface effects. For example, subsurface movement of liquids and gases, both during and following active retorting periods, has not been adequately defined. Definition and solution of this hazard, if one does exist, will require installation of monitoring wells in and around in situ sites to provide samples and to permit frequent inspection of subsurface conditions. Until such uncertainties are satisfactorily resolved, it cannot be determined whether in situ processing is the environmentally favorable method of development.

5. "Waterless" Retorting Process

One respondent interpreted the draft statement as describing "two waterless retort methods" and questioned why gas combustion retort research has been allowed to come to a halt (32).

Response

The interpretation that the Union and Gas Combustion retorting methods require no water is incorrect. The entire retorting process consumes less than 10 percent of the total water required for oil shale development. However, all retorting processes use some water (up to 0.7 cubic feet per second for a 50,000-barrel-per-day operation) and all produce water (from 0.2 to 0.7 cubic feet per second) which is useable in other phases of the operation. Therefore, any "water savings" which might result from use of one type of retort over another type would be relatively insignificant.

Development of the gas combustion process was advanced by the Bureau of Mines to the point of demonstrating a relatively small unit in 1955. At that time, the Congress refused further funds, feeling that subsequent development should be left to industry. In the late 1960's, industry did make further advances, but full demonstration would require scale-up to a commercial scale plant. Whether or not this scale-up will be undertaken is uncertain at present; however, the process is considered sufficiently advanced that it could be advanced to the stage of industrial application over a several year period.

6. High-grading of Oil Shale

A question was raised concerning extraction ratios and the objective of discouraging "high-grading" (7).

Response

High-grading would be discouraged by the Department of the Interior regulations governing mining (30 CFR 231, 231.31 Ultimate Maximum Recovery; Information Regarding Mineral Deposits) which require mining operations to be conducted in a manner to yield the ultimate maximum recovery of the mineral deposit, consistent with the protection and use of other natural resources and the protection and preservation of the environment - land, water, and air.

An extraction ratio of 75 percent was achieved at the Bureau of Mines demonstration mine because rock mechanics studies showed that 60-foot square pillars and 60-foot wide rooms could be safely mined in the Mahogany Zone at shallow depths of 400 to 600 feet.

In multi-panel development, as would be the case in a full-scale operation, barrier walls would be left between pillars and at least some of the relatively long access adits for main haulageways would not be opened to full mine height. Also, more pillar area in relation to room area would be required for roof control in many locations where the shale is more deeply buried and the overburden pressure is consequently greater than at Anvil Points. These differences from the basic Anvil Points situation would decrease the extraction ratio to between 50 to 60 percent for the prototype sites studied in Volume III, Chapter III. These factors are also discussed in the Final Statement in Volume I, Chapter I.

7. Processing Nahcolite/Dawsonitic Oil Shales

The Department was criticized for not offering potential lease sites in that part of the Piceance Creek Basin of Colorado containing significant concentrations of nahcolite and dawsonite. It was suggested that operations based on such shales may be the only ones that "can economically pioneer commercial oil shale production" and that "the leasing program must be supplemented to include development of (such) oil shale." In addition, a proposed approach was presented to process nahcolitic/dawsonitic oil shales and use of recovered nahcolite and aluminum compounds for flue gas and water treatment, respectively (13, 74, 207, 225).

Response

The presence of minerals other than shale oil contained in, or associated with, oil shale was considered in the selection of the six proposed prototype tracts (Volume III, Chapter IX, Section H.)

The environmental statement has also been revised in Volume I, Chapter I, Section C, to reflect current developments in the technology of processing the dawsonite and nahcolite in oil shales, including those by private companies, as reflected in the recent patent literature. Section C also considers use of nahcolite and aluminum compounds for flue gas and water treatment. None of these processes has as yet been examined in total on a large scale, The economics of sodium minerals recovery and their influence on oil shale economics therefore are still not completely understood. This is also true of the effects of their production upon existing markets for the derived products among which are sodium aluminate, alumina, sodium bicarbonate, and crude nahcolite.

Thus, while it is likely that mineral products other than shale oil would play some role in future oil shale development, the importance of such mineral products to overall economic viability is uncertain at this time.

8. Sodium - Rich Salt Beds

The Draft Environmental Statement described sodium-rich salt beds occurring with oil shale. No mention was made of how these highly soluble salt beds will be handled; whether they will be mined with the shale, processed, and then disposed of with the spent shale, or separated and disposed of prior to processing, or left in place. Particular emphasis was placed upon the possible effect on the salinity of the Colorado River (22).

Response

The proposed prototype oil shale tracts contain no bedded halite (NaCl) resources. Thus, handling of such salt beds will not be a factor in prototype development. However, since such resources do exist in other parts of the oil shale region (Volume I, Chapter II), if additional tracts are offered for lease, there is a possibility that bedded halite will be found in some of the lower oil shale beds. It is not likely that production of salt would be economically attractive in this area. Halite is found in a great many areas outside the oil shale region and is usually produced only when large populations and/or consumptive markets exist near the basic resources.

If marketable, development of halite would require leaving an undisturbed thickness of oil shale both above and below the halite. If not marketed, the halite which is intimately associated with the oil shale beds would be mined with oil shale and disposed of in the spent shale dumping areas, using systems similar to those described in Volume I, Chapter II, Sections C and D.

The Final Environmental Statement includes estimates of the water required for mineral processing (Volume I, Chapter III, Section C), and the land requirements, including those for processed shale disposal, fall within the ranges estimated in Volume I, Chapter III, Section B. Potential salinity effects on the Colorado River system are included within those estimated in Volume I, Chapter III, Section C.

9. Disposal of Soda Ash and Alumina

The Draft Statement did not consider the disposal of large quantities of soda ash or alumina as waste products (39).

Response

Soda ash and alumina are manufactured products subject to processing control and storage prior to marketing. If not processed, nahcolite and dawsonite present in the raw oil shale feed would be disposed of with the spent shale in the dump areas (See Volume I, Chapter I, Sections C and D.) Any rich dawsonite/nahcolite ores could be stockpiled for future processing. All storage piles and waste disposal areas would be susceptible to leaching (See Volume I, (See Volume I, Chapter IV, Section C), and subject to the controls provided for in the proposed lease stipulations (Volume III, Chapter V.)

10. Alternative Systems of Surface Disposal

Alternative systems of surface disposal which have fewer adverse impacts than the "hydraulically placed valley fills" should be considered. It was suggested that a possible approach would be to draw more fully from experience and technology of earth-embankment design and construction in the transportation and placement of the waste. It was also suggested, to avoid drainage courses, that the disposal areas be designed as topographic benches, trenches, or mesa-like hills that would better harmonize with the natural landscape (6).

Response

The discussion of waste disposal methods presented in the Environmental Statement is not meant to be all-encompassing. The systems described (Volume I, Chapter I, Sections C and D) are considered the methods most likely to be used in initial developments. They were used to assess the probable environmental impacts, (Volume I, Chapter III, and Volume III, Chapter IV). Canyon fill will provide maximum pile support with minimum acreage requirements. As experience is gained in solid waste management, however, various methods of waste disposal could be employed, including those suggested above, and their relative advantages and disadvantages evaluated.

11. Mining Subsidence

Possible surface subsidence as a result of room and pillar mining should be more fully discussed. In particular, the seismicity of the area and the degree of fracturing of the oil shale - both factors related to possible surface subsidence - should be discussed in the Final Environmental Statement (13, 39, 42).

Response

Surface subsidence from underground mining is a function of the width and height of the underground opening, as well as the depth of the opening below the surface. The mining plan must account for these factors and relate them to the potential for surface subsidence.

Long-range potential for significant subsidence can be reduced by back-filling of underground workings with spent shale. Additional information concerning the possibility and effects of subsidence,

including seismicity, is in Volume I, Chapter III, Section B, and Volume III, Chapter IV, Section A. The detailed mining plans required under the proposed program will permit evaluation of possible pillar fractures which would tend to increase the possibility of subsidence.

12. Electrical Transmission Lines

The Draft Statement leaves the impression that it is current Bureau of Reclamation practice to utilize "clear-cutting in constructing transmission line rights-of-way (6).

Response

The paragraph in question (contained in Volume II, Chapter V, Section B.8), while not intended to convey the impression suggested above, has been clarified.

13. Pyrolysis and Production of Carcinogens

The Draft Environmental Statement did not mention that pyrolysis also produces carcinogens, nor did it discuss how to remove carcinogens and other hydrocarbons (19).

Response

While there are no known means of preferentially removing carcinogenic compounds during retorting, pyrolysis occurs in a closed system and liquids and gaseous products will therefore be contained. However, any crude petroleum can and often does contain polycyclic compounds, some of which are known to be carcinogenic. Dr. W. C. Hueper of the National Institutes of Health, Johns Hopkins University,

an authority on the carcinogenicity of petroleum, synthetic petroleum and petroleum products, has studied the oil shale retorting process and found that the resulting shale oil was slightly carcinogenic (at occupational exposure), but at a level comparable to many crude petroleum samples. Actually, carcinogens occur in almost any naturally occurring organic material. Fortunately, the body is resistant to concentrations encountered in nature. No evidence to date indicates that a shale oil industry poses a hazard significantly different than any other fossil fuel industry. (See also Section D.3 below for a discussion and additional references concerning the carcinogenic health hazards associated with oil shale dust.)

14. Black Mesa Slurry Pipeline and Water Monitoring

Mention should be made of the water monitoring program being conducted as an integral part of the slurry pipeline mining operation at Black Mesa, Arizona (1).

Response

This unique coal slurry facility, along with other slurry operations (pneumatic, belt conveyor, gondola, rail, and truck transport) may be a feasible means of moving oil shale and/or processed shale. It is understood that at the generating station, the "clear water" from the flocculator tank containing 25 ppm of suspended solids may be used for cooling tower make-up, ash-handling water, or other plant use. No disposal of any effluent is allowed into the Colorado River or into the soil. Therefore, all water brought into the system through the pipeline must eventually be evaporated. Any excess

water will be diverted to a large evaporating pond, located adjacent to the generating station. Monitoring wells in the vicinity of the evaporation pond and the ash-disposal area are utilized to monitor the water level and water quality. Water is also monitored within the power generating plant. For additional information and references, see Volume II, Chapter V, Section B.5.

15. Oil Shale Development "Within An Acceptable Range of Judgment"

The development profile presented by the Department of the Interior for an oil shale industry falls within an acceptable range of judgment based on national energy needs and the level of technologic capability (24).

Response

The Department's projected development schedule to a 1-million barrel-per-day level is detailed in Volume I, Chapter III, Section A. No changes in the schedule were deemed to be necessary for the purpose of the analyses presented therein, although it is recognized that other development schedules are possible.

B. Surface Water

The impact of an oil shale industry on surface and ground water was the subject of extensive comment during the review and public hearing process. Because of the complexity of the subject, and the many interrelationships of demand, supply, and quality impacts on water, the subject was treated by expansion of the description and impact sections of the Final Environmental Statement, and by specific response to comments, as set forth below. The reader is referred to the following sections of the Final Environmental Statement for a detailed discussion of the water topic:

Vol. I	Chapt. I	Sec. D.7
Vol. I	Chapt. II	Sec. A.5.a, Sec. A.5.b, Sec. C.1, Sec. C.2, Sec. C.5, Sec. D.5,
Vol. I	Chapt. III	Sec. C.1, Sec. C.2 Sec. C.3, Sec. C.4 Sec. C.5, Sec. C.6
Vol. I	Chapt. IV	
Vol. I	Chapt. V	Sec. C
Vol. I	Chapt. VI	Sec. C
Vol. III	Chapt. II	Sec. B.1.d, Sec. B-2.d, Sec. B.3.d, Sec. B.4.d
Vol. III	Chapt. IV	Sec. B
Vol. III	Chapt. VI	
Vol. III	Chapt. VII	

1. Availability - Water Rights - Augmentation

Questions were raised concerning: the amount of water available for an oil shale industry and for municipal and industrial use; water rights in Colorado, Utah, and Wyoming; and methods of augmenting flow in the Colorado River (2, 7, 20, 28, 30, 36, 39, 202, 222, 287).

Response

Several pages of additional details on the availability of water, the amount each State is entitled to, and the possibilities

of augmenting supplies in the upper basin have been inserted into Volume I, Chapter II, Section A.5.

The added material lists the present depletions by type of use, the amount of future depletions that are committed, and the remaining uncommitted water allocated to the states. A partial listing of water permits granted to oil shale industrial applicants is also included. Methods of augmenting water supplies in the Colorado River Basin by weather modification and desalting geothermal brines are also considered, as are ways of increasing the supply of useable water by better management and distribution, and by desalting point sources of high salt input to the system.

2. Water Quality - Salinity

A number of comments inquired about the adverse effects on water quality in the Colorado River caused by the use of water by an oil shale industry (7, 20, 22, 28, 32, 33, 36, 43, 202, 214, 222, 228, 258, 282, 283, 287).

Response

Additional discussion on the effects of water use on water quality have been added to Volume I, Chapters II, III, and V. See, in particular, Volume I, Chapter II, Section C. The specific amount of the increase in salinity cannot be defined until specific mining plans are known. Similarly, the impacts of a complex oil shale industrial development cannot be precisely quantified although reasonable judgments can be made concerning possible adverse effects. If the water required to support a 1-million-barrel-per-day industry were withdrawn totally from surface supplies, salinity would increase

in the Lower Basin due to the concentration of salts in a smaller quantity of water. The most likely range of salinity increase at Hoover Dam due to oil shale development to the 1-million-barrel-per-day level is estimated at 10 to 15 mg/l over the current (1970) level of 760 mg/l. This increase in salinity would cause an economic detriment in the Lower Colorado Basin estimated to range from $670,000 to $1,000,000 per year. Under more extreme water demand conditions (e.g., assuming consumption of 341,000 acre-feet per year) the salinity would increase by 27 mg/l and the economic disbenefit would approximate $1,800,000.

In addition to these salt concentrating impacts from the consumptive use of surface water, salt loading would also increase the salinity in the Colorado River System and at Hoover Dam. The potential sources of this additional salinity increase include leaching of spent shale, both during waste pile buildup and after revegetation; reinjection of mine water and upward movement and surface discharge of saline waters; accidental release of low quality mine water, including failure of evaporation ponds; and any return flows of saline water. Additional impacts on water quality would be caused by accidental spillage of processing effluents, chemicals, and waste products.

3. Domestic Water

There will be a need to supply water to meet the domestic requirements of the population increase associated with an oil shale industry. Several comments suggest that the need for this water has been overlooked (28, 163, 214, 231).

Response

The need to supply water to meet domestic requirements was considered in the Draft Statement. However, the Final Statement has been modified to more clearly reflect that consideration. For example, the water requirements set forth in Table III-5, Volume I, Chapter III, Section C, includes a separate category of water to meet domestic requirements of the associated population. These requirements include water that would be needed for such uses in households, sewage disposal, lawn watering, air conditioning, etc.

4. Yellow Jacket Project

Sources of water supply for oil shale development in the Piceance Basin of Colorado are presently being investigated. One possibility is a project at Yellow Jacket which would result in approximately 70 percent of the water supply for municipal and industrial uses. One comment questioned the Bureau of Reclamation's legal authority to develop municipal and industrial water for uses other than those incidental to agricultural use. It also stated that only 30 percent of the money appropriated for a project can be utilized to build future capacity (36).

Response

The Yellow Jacket Project is named as a participating project pursuant to Section 2 of the Colorado River Storage Project Act of April 11, 1956 (70 Stat. 105). Studies are currently under way to evaluate alternatives but the report is not yet completed. The feasibility report should outline the beneficiaries of alternative

plans of action and can serve as a basis for any Congressional authorization. Congress, therefore, if it should authorize a project, may recite municipal and industrial water as one of the beneficial purposes as provided in the Colorado River Storage Project.

The Congress, through the Colorado River Storage Project Act, made clear its intent that water for municipal uses could be a major purpose of the project and not be subject to quantity limitations. One of the alternatives presently formulated at Yellow Jacket is within the statutory guidelines relating to inclusion in the project plan of a municipal and industrial water function.

The Water Supply Act of 1958, Subsection (b), authorizes storage in any reservoir project for present or anticipated future demand for municipal or industrial water. The second proviso states that local interests shall agree to pay for the cost of providing such storage for municipal and industrial purposes to meet present demands before construction or modification of the project is initiated.

The third proviso states that as much as 30 percent of the total estimated costs of a project may be allocated to anticipated future demands where evidence exists that such storage will be used in time to permit the payout of such costs within the life of the project.

It is clear from this subsection that local interests may contract for water storage for present municipal and industrial use without quantity limitation. The same interests may also reserve storage to meet anticipated future municipal and industrial water requirements subject to the limitations on the amount of costs that can be allocated to meet these future requirements as set forth in this subsection.

5. Availability of Surface Water in Colorado

There is good reason to doubt the actualy availability of up to 5.8 million acre-feet per year of water for consumptive use in Colorado (28).

Response

The comment is correct, 5.8 million acre-feet per year of water is not available to Colorado. This is the total amount that is available to the four upper Colorado River Basin States in Arizona, Colorado, Utah, and Wyoming. The basis for this estimate, the amounts available for depletion, committed future supplies, and the amount potentially available for oil shale development is documented in Volume I, Chapter II, Section A.5.

6. Water Supply - Naval Oil Shale Reserves

United States claims on 200,000 acre-feet of water from the Colorado and White Rivers for the Naval Oil Shale Reserves should be considered (20).

Response

The status of the Federal claim to 200,000 acre-feet of water is still uncertain and court adjudication proceedings are under way in Colorado. Until these proceedings are completed, the extent of water rights for reserved lands in Colorado, including the Naval Oil Shale Reserves, cannot be determined. This supply uncertainty is recognized (See, for example, Volume I, Chapter III, Table IV-6, in Section C.)

7. Private Water Supply

Potential legal problems are associated with acquiring a supply of water from private sources (28).

Response

As discussed in Volume I, Chapter II, Section A.5, water rights can be purchased and a change of use can be made with the concurrence of the State District Court. The possible impact on various water users is also considered in Volume I, Chapter III, Section C. The issuance of a lease under the proposed prototype program would not entitle the lessee to water. Rather, any private developer will need to obtain his own water supply. No attempt has been made to resolve all of the potential legal problems private parties might encounter in acquiring such supplies. However, the impact on existing users is considered in Volume I, Chapter III, Sections A and C.

8. Future Water Supply Projects

The Final Statement should balance the benefits of future water supply projects against the benefits to be gained as compared to alternative uses (28).

Response

As discussed in Volume III, Chapter IV, Section B, adequate amounts of water are potentially available from ground water and from surface water supplies contained in existing reservoirs to support prototype oil shale development. The need to construct additional reservoirs must be judged on its own merits, including a thorough analysis of benefits and costs. The demand for and supply of water for mature industrial development is considered in Volume I, Chapter III, Section C.

9. Impacts of Augmentation Projects

The impacts associated with weather modification, desalting, and other water augmentation projects should be mentioned (28).

Response

As discussed in Volume I, Chapter III, Section C, water is potentially available from ground and already constructed surface water sources to more than meet the needs of a 1-million barrel per day shale oil industry, including related urban development. The uncertainties associated with the suggested supply augmentation projects are also noted. If augmentation is needed to support a larger oil shale industry in the future, the benefits and environmental costs will be weighed at that time. While they have not been detailed in this statement, it is recognized in the Section referenced above that such projects would include additional impacts on the environmental values of the oil shale areas.

10. Concentration of Dissolved Materials

The summary of the Colorado State University experiments in Volume I, Chapter I, fails to mention the extremely high concentration of dissolved materials that were found in the first small volumes of water that passed through the spent oil shale (8).

Response

It is true that initial concentrations of dissolved materials were high, but decreased with continued passage of water through the sample and ultimately approached a steady state level. Those experiments have been described more fully in Volume I, Chapter III,

Section C, in an analysis of the amount of material that may be leached from a waste disposal pile under a heavy rainstorm condition.

11. Effect of Leachates from Nahcolite, Dawsonite, and Halite from Spent Shale

An evaluation of leachates from nahcolite, dawsonite, and halite that may be distributed throughout the overburden material should be presented (7).

Response

To date, sufficient quantities of nahcolite, dawsonite, and halite-bearing oil shale have not been extracted to make meaningful analyses of the leachates. The data that are available have been explored and used in Volume I, Chapter I, Section C, to evaluate the potential impacts from leaching caused by a heavy rainstorm. That section also describes the chemical quality of saline discharges in the Piceance Creek Basin. It is unlikely that the saline minerals leached from the waste piles would be significantly different from those occurring naturally, but the ions may be in different proportions. The analysis now contained in the sections referenced above covers a broad range of possibilities in order to present a realistic analysis of the probable impact on salinity due to spent pile leaching.

12. Leaching

The Statement was not explicit as to how the problem of leaching will be handled (23).

Response

Provision must be made to convey the spent shale to a disposal site and to create a stable pile to prevent erosion and/or leaching

of sediments and resident materials. General design parameters for oil shale disposal sites are discussed in Volume I, Chapter I, Section D. The lease stipulations (Volume III, Chapter V) include provisions for controlling this potential problem. Explicit plans for handling specific leaching problems will be incorporated into the detailed development plan required under the proposed program.

13. Water Quality Antidegradation Policies

One comment related to the 7th session of the Conference on the Pollution of the Interstate Waters of the Colorado River and its tributaries. The policy adopted at that session would have as its objective the maintenance of salinity levels at or below levels presently found in the lower main stem. It was requested that the Final Statement address this question and clearly indicate that oil shale development may violate the antidegradation statements of the approved water quality standards for the States of Colorado, Wyoming, and Utah (7).

Response

The conference discussed above and the salinity levels of the lower main stem of the Colorado River are considered in Volume I, Chapter II, Section A.5. A Federal program of water quality maintenance has been initiated. The potential water quality impacts of a mature oil shale development are detailed in Volume I, Chapter IV, Section C, and the expected impacts of prototype development are assessed in Volume III, Chapter IV, Section B.

Lessees will be required to comply with all applicable Federal and State water quality standards. It is recognized, however, that even with such controls, mature oil shale development would create a potential for possible violation of the antidegradation policies. Indeed, it is one of the purposes of the prototype program to assess actual water quality effects in order to allow more accurate predictions with respect to the possible affects of full-scale regional development.

14. Opportunity Costs

No mention is made of the opportunity costs associated with water used in oil shale development and therefore foreclosed for other agricultural, recreational, and other usages (36).

Response

The Statement recognizes and discusses the possibility that water used for oil shale development forecloses its use for other purposes. (See Volume I, Chapter III, Section C, and Volume III, Chapter VII).

C. Ground Water

1. Assessment of Ground-Water Resources and Impacts on these Resources

Various comments questioned the assessment of and impacts upon ground-water resources and called for expanded discussion of that subject. Several questioned the analysis resulting in the estimate that overall development of oil shale could result in production of surplus water (6, 7, 13, 23, 28, 30, 36, 44, 214, 282).

Response

Additional hydrologic information was developed during informational core drilling. These data have been incorporated into the analyses detailed in Volume I, Chapter III, Section C and Volume III, Chapter IV, Section B. These analyses assume the maximum production of ground water from mine dewatering in the Piceance Creek Basin. Should these maximum rates be realized, it will result in surplus amounts of water.

A detailed development plan will be required by the Department of the Interior before operations will be allowed to begin. The plan must contain a complete description of the water supply sources, facilities, and the expected demand curve, including the amounts and the quality of the water needed. Also, the plan must include descriptions of the techniques that will be used to prevent damage to the water resources. This plan will be subject to public review and possible revision before operations begin. The lease stipulations (Volume III, Chapter V) have been modified to require the collection of hydrologic data and to define base line conditions from the site

for two consecutive full years, at least one of which must be prior to development. Thus, the lessee will be required to provide specific hydrologic data from the site, such as observation well and streamflow records, to supplement hydrologic data collected by the Geological Survey and Colorado Department of Natural Resources.

2. Variations of Water Quality

The draft statement does not consider variations of water quality and quantity with respect to the time that water of specified quality is needed (28, 30, 36, 285).

Response

Changes in the quality of the water produced from a mine with time is discussed in Volume I, Chapter III, Section C, and Volume III, Chapter IV, Section B. However, detailed predictions of the variations in water quality over time is not possible with existing data.

Deriving a demand curve that indicates the rate and quality of water necessary for an oil shale operation requires that a development plan be selected and designed. The lease stipulations in Volume III, Chapter V, have been revised to insure that such a plan and additional data will be available for public review before final operating plans are approved.

3. Exploration Wells

The impact of water production from exploratory wells (mine dewatering) was questioned (2).

Response

The effects of large withdrawals of ground water will be similar whether the ground water is withdrawn from a mine or closely spaced

production wells. The volume and rate of withdrawal is more determinative of the effects of withdrawal than is the techniques of withdrawal. This subject is fully discussed in Volume I, Chapter III, Section C, and Volume III, Chapter IV, Section B.

4. Water-level Declines

Large withdrawals of ground water will cause water level declines and the effects of these declines have not been described (2, 30, 214, 228.)

Response

The possible effects of water level declines are discussed in Volume I, Chapter III, Section C, and Volume III, Chapter IV, Section B. These discussions clearly indicate that certain effects, such as springs drying up or saline water movements, are caused by the water level declines, which in turn are caused by the ground water withdrawals. The amount that the water level may decline is estimated as is the number of wells and springs that may be impacted (See Volume IV, Chapter IV, Section B.)

5. Rocks Above Mahogany Zone

Large withdrawals of ground water from the bedrock above the Mahogany zone will not induce saline water to move toward the withdrawal points (Supplemental Material, C-9.)

Response

The vertical permeability of the Mahogany zone is relatively low, and this zone retards upward movement of saline water. However,

fractures cross the Mahogany Zone, and rocks above and below the zone are hydraulically connected, and water moves upward into overlying rocks where the pressure head in the rocks beneath the Mahogany Zone is higher than in the overlying rocks. In these areas, withdrawals of ground water from bedrock above the zone would decrease the pressure head in the overlying rocks and increase the movement of saline water below the zone upward toward the point of withdrawal. Along Piceance Creek in the northern part of the Basin, the bedrock above the Mahogany Zone contains saline water that in part is derived from rocks beneath the Mahogany Zone.

6. Land Subsidence

There is no apparent basis to indicate that dewatering of leached zone may lead to compaction of the Green River Formation and cause local land subsidence (Supplemental Material, C-9).

Response

In an artesian aquifer system, part of the weight of the overlying formations is supported by the pressure head within the aquifer. Withdrawals from an artesian aquifer lower the pressure of the water in the aquifer. Lower water pressure increases the load from the weight of the overlying rocks that the skeleton of the aquifer must bear. The additional load on the aquifer skeleton may cause the skeleton to compact.

The physical properties of the rocks in the leached zone may be such that these rocks will compact when the water pressure is reduced in the leached zone. If this zone compacts, it could cause land subsidence.

7. Leaching

Will water percolating through deposits of spent shale dissolve minerals from the deposits and contaminate the water resources of the area? (13, 19, 823).

Response

Surface leaching of unconsolidated materials will occur and materials washed from the piles must be impounded and therefore would not enter the natural drainage system but would be retained and evaporated or recycled for use in the disposal operations.

Once the material has been moistened and compacted, it forms a hard pan that would limit water penetration to the top 1 or 2 foot layer at the surface. It is expected that water would percolate through the deposit very slowly during the early years after compaction. Ultimately, shale wastes will weather to greater depths. The effects of this are uncertain as discussed in Volume I, Chapter III, Section C.

8. Leached Zone

Removal of water from the leached zone should have little effect on streamflow or springs, for the surface hydrologic system is generally controlled by the aquifers that occur above the top of the Mahogany Zone (Supplemental Material, C-9).

Response

Most springs and streams in the Piceance Basin issue from or flow over rocks above the Mahogany Zone. In many places, however, ground water that feeds these surface waters, passes through fractures in the Mahogany Zone. While the Mahogany Zone restricts the movement of water between the leached zone and overlying aquifers, the Mahogany Zone is not a perfect barrier and removal of water from the leached zone will affect surface flows. Although the Mahogany Zone reduces the effects of the removal of water from the leached zone on overlying aquifers, the fractures allow an undefined degree of hydrologic communication between the leached zone and overlying aquifers.

9. Utility of Trial Water Balance

The trial water balance should be replaced by a model that relates, for any given time, the quantity and quality of the water needed for oil shale development (28, 38).

Response

A model that relates, for any given time, the quantity and quality of the water supply to the water demand will be useful for describing water supply problems and possible solutions to them. However, available data will not enable the development of a sophisticated model. Such a model, built with presently available data, would tend to impart an unwarranted feeling of security to the users of the model. The trial water balance illustrates one of the roles that ground water can play in oil shale development and a possible alternative that may be considered based on the data currently

available. The exact amount of water that will be available from a particular mine is not known. Additional water studies will be required before a firm water plan is adopted for a particular operation. The Final Statement clearly indicates the purpose of the water balance presented in Volume I, Chapter III, Section C.

10. Sources of Error in the Trial Water Balance

Errors in the trial water balance should be explicitly disclosed and the effects of possible error enumerated (28, 30).

Response

Volume I, Chapter III, Section C, indicates that the principal potential for error in the trial water balance involves the assumption that the values of the water-bearing characteristics of the rocks are near the maximum known volume. Thus, the estimate of the water produced from the mine is the maximum amount of water that could be expected. Should the other extreme occur, i.e., no water from the mine, the obvious alternate water supply would be from surface water sources, as described in the above referenced section. The supply for large-scale oil shale development will most likely consist of a combination of water from mines, wells, retorting, refining, and rivers.

11. Relation of Trial Water Balance to Water Requirements for a 1-Million Barrel per Day Industry

Can the water requirements given in the trial water balance (Volume I, Table III-6) be considered proportional to the water requirements for a full-scale industry given in Table III-8? (28, 39, Supplemental Material, C-9).

Response

The water balance in Volume I, Chapter III, Table III-7 describes the water demand-supply conditions for a given location with an assumed technology and local hydrologic conditions. Such an analysis is not designed to account for all regional hydrologic variables and should not be projected to a 1-million barrel per day regional oil shale industry. However, the potential role of ground water in reducing surface water requirements for that scale of operation is depicted in Figure III-9 of Chapter III, Volume I.

12. Water Production from a Hypothetical Mine

One of the major sources of water for oil shale production may be water obtained from dewatering a mine, yet the amount of water from this source has not been accurately predicted (28, 214, Supplemental Material, C-9).

Response

The amount and quality of water available from mine dewatering depends upon the type of mine and its operation as well as the hydrologic parameters of the aquifers penetrated by the mine. At this time, the amount or quality of water can only be estimated because neither complete hydrologic data nor detailed mining plans are available.

In estimating the amount of water produced from a hypothetical mine, one of the assumptions was that the rocks penetrated by the mine were saturated with water. A further assumption was that the water-bearing characteristics of the rocks were near the upper limits suggested by field studies. Thus, the estimate represents

the most water that could be expected and would have the greatest impact on the ground water reservoir. Such an estimate is necessary to allow planners and decision-makers to consider the effects both from a water supply and a mining point of view. Oil shale deposits in certain areas of Colorado, Utah, and Wyoming contain little or no water and in these areas, a mine would have little or no effect on the ground water reservoir. The discussion in Volume I, Chapter III, and Volume I, Chapter IV, has been modified to clearly indicate the assumptions used in the estimate and the purpose of the discussion.

13. Cumulative Effects of Mine Dewatering

Cumulative effects of mine dewatering and other withdrawals from the ground water reservoir made during early stages of development have not been considered (28, 30, 36, 44, 214, 285).

Response

The cumulative effects that mine dewatering during early development will have on ground water resources during later stages of development are detailed in Volume I, Chapter III, Section C, and Volume IV, Chapter IV, Section B. These descriptions are based on cause-effect relationships as they are known from present data. However, the cause-effect relationships and the hydrologic parameters that relate the effect to the cause need to be quantitatively described. Data necessary for a more accurate quantitative description will be collected as required by the lease stipulations.

14. Ground Water Contamination; Impervious Impoundments

Impoundments downstream of disposal areas must be impervious so as to prevent leaking into subsurface water (23).

Response

Control of impounded waste waters is provided for in the proposed lease stipulations (Volume III, Chapter V), but the particular method of control is not specified since control methods will vary according to location and site characteristics and the method of development. Technology presently available is sufficient to control seepage of retained waters from such impoundments under these varying circumstances, e.g., clays and vinyl lining, but an impervious seal is, in practice, almost impossible to achieve over long periods of time.

15. Ground Water Contamination; Lined Shale Piles

Are there plans to line spent shale piles with an impermeable barrier and will the runoff be permanently impounded?

Response

Presently available data (Volume I, Chapter I, Section D) indicate that the spent shale material will have very low permeability after compaction. Thus, the proposed program does not specifically require lining the spent shale disposal area. Sound engineering practice would include compaction of the sub-base and base prior to disposal, and possibly, special mixtures to decrease the permeability

of the basal layer. The spent shale will be progressively compacted by heavy equipment and the pressure of the overlying layers.

Runoff water will be controlled by a series of dams and spillways that will provide a high standard of containment exceeding 50-year rainfall/runoff conditions for the area (Volume III, Chapter V).

D. Impacts on Air Quality

The primary concerns regarding the effects of a prototype oil shale leasing program on air quality center around cumulative regional impacts, the desire to approach zero degradation of what is now essentially high quality air, and the unique problems associated with regional temperature inversions. The Final Environmental Statement discusses the management of dust (Volume I, Chapter I, Section D.5.a and Section D.5.c), environmental monitoring (Volume I, Chapter I, Section D.7), and the impacts on overall air quality (Volume I, Chapter III, Section D). Section D discusses the air pollution potential of an oil shale industry, including mining and stack gas pollution, a mathematical model of possible dispersion of air pollutants from a stack, and the effects of various gaseous pollutants such as sulfur dioxide, oxides of nitrogen, and carbon monoxide on human, animal, and plant life. A discussion of noise and the impacts of an oil shale industry on air quality is also given in Volume III, Chapter IV, Section C. Additional summary impact analysis is provided in Volume I, Chapter IV; Volume I, Chapter V, Section D; Volume I, Chapter VI, Section D; and Volume III, Chapter VI.

1. Seasonal Variations

Since the amount of particulates in the air, water salinity, etc., will vary with the seasons, environmental "base-line" information for each month of the year is needed for each of the proposed lease sites so the true environmental impact of the oil shale operation can be determined (59, 202).

Response

The lease stipulations (Volume III, Chapter V) have been revised to provide that each lessee shall monitor, under Departmental supervision, appropriate environmental parameters over a period of two consecutive full years in order to establish a base line of data on the existing environment. At least one year of that collection of base line data must precede the submission of the development plan under Section 10 of the lease. Monitoring of air quality will be required, resulting in a determination of seasonal variations against which actual impact will be measured.

2. Degradation of Air Quality

Concern was expressed over the quantities of pollutants which might be emitted by a million barrel per day industry and related urban development and the resulting impact on ambient air quality (7, 19, 29, 32, 136, 137, 202, 211, 222, 228, 229, 258, 280).

Response

The quantities of sulfur oxides, nitrogen oxides, and particulates emitted from a typical 50,000 barrel per day surface plant and associated upgrading facility are given in Volume III, Chapter IV, and are based on the more detailed data in Volume I, Chapters I and III. These data and meteorological data from 4 monitoring stations located between Colorado Tracts C-a and C-b (operated for one full year under a contract by the Atomic Energy Commission in conjunction with its May 1973 Rio Blanco nuclear stimulation experiment) were evaluated by an independent contractor for the Department of the Interior.

The study is available for inspection [1/] and provided the basis for the information contained in the air impact section of the Final Statement (Volume I, Chapter III, Section C.)

In this analysis, it is evaluated that development to a 1-million barrel per day industry will require 17 processing complexes, the locations of which are uncertain. In addition, populations will expand, as will power generating capacity. Some secondary industry may be stimulated by the general activity related to oil shale development. For the whole region, the cumulative long-term effect will be influenced by the location of plants and people and the potential for synergism between individual pollutants.

It is anticipated that all applicable ambient air quality standards can be met, both Federal and more stringent State standards. However, Colorado's 1980 standard that limits the amount of sulfur that can be released from a single source could probably not be met without improvements in stack gas control technology or changes in the standards.

Assuming no concentrating effects from scattered point sources, the cumulative long-term effects upon the region will likely be:

1. A decline in ambient air quality;
2. Increased occurrence of smoke plumes, an increase in haze, and some lowered visibility;
3. Localized and limited damage to vegetation and animals over long periods of time;
4. Possible injurious, but generally reversible effects on humans working or living in the vicinity of the plants if an accident occurs; and

1/ See the list of references in Volume IV, Section C, Reference C-24

5. Possible short-term effects on persons living in the vicinity of the plants during inversion conditions.

If synergism between individual pollutants occurs and/or plant siting leads to higher concentrations of pollutants than expected, more severe impacts than those listed above may result.

In order to present more detailed analyses than that contained in the Final Statement, it will be necessary to have more detailed site data, such as the plant location relative to its physical setting, meteorological conditions as a function of time, and the actual processing sequences to be employed. Such data do not currently exist, but would be developed for each site under the provisions of the prototype program.

The feasibility of locating processing facilities on upland slopes is determined by the topography of each site in relation to local and regional meteorological conditions; by mine, plant and processed shale dump design parameters; and by overall process economics. As a practical matter, however, upland sites would be favored as one way to reduce the cost of high stacks and to achieve better dispersion of pollutants.

It is not possible to quantatively assess the cumulative non-oil shale industrial impacts on regional air quality as the shale industry grows since the size, nature, and rate of growth of these industries are not known. However, any effects for such development would be additional to the effects discussed above for oil shale development itself.

3. Pollution Control, Toxic Materials, Airborne Particulates

The reliability of large-scale air pollution control technology was questioned, and the possibility of toxic materials in airborne particulates was raised. The airborne particulates from a full-scale industry (400 tons per day) was stated to be unacceptably high (7, 14, 19, 226, 229).

Response

The reliability of specific air pollution control technology for an oil shale industry has not yet been demonstrated. One of the purposes of the prototype program is to determine the reliability of such technology. It should be noted that modern air pollution control technology is constantly improving in efficiency, including the methods used in high volume industries. The petroleum industry, which processes materials in large amounts, is an obvious example. Oil shale production, which must necessarily be high volume, can probably control its air emissions within acceptable limits, if appropriate technology is utilized, as indicated in Response 2 above.

It is most unlikely that the particulates from oil shale processing will contain significant or harmful.[1/] However, monitoring for these substances may be required by the Mining Supervisor pursuant to the lease stipulations. Initial tests on TOSCO processed shale performed by Kettering Laboratory in 1965 concluded that this spent

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1/ Mercury averages 0.1 parts per million (ppm) and lead averages 40 ppm in spent shale.

shale, although it contains carcinogenic compounds, was no more carcinogenic and harmful to human health than most common dusts (report referenced in Volume I, Chapter III, Section D).

An expanded study regarding potential carcinogen concentrations in raw shale, processed shale, and associated plant life was initiated by Denver Research Institute in 1971 and should be completed prior to production from any of the proposed lease sites.

The processed shale is assumed to be wetted with approximately 20 percent by weight prior to disposal, in order to promote compaction and control of dust. Wetting promotes cementation reactions in those wastes in which the carbon content of the spent shale is low, thus further protecting the surface to some extent against strong winds and mechanical abrasion. Deep canyon disposal provides the best protection against wind erosion. Disposal near the top of a mesa would have the disadvantage of higher wind velocities. However, such locations have cooler temperatures, longer duration of snow cover, and general higher ground moisture retention that encourages more thriving vegetation, which tends to reduce the potential for airborne particulates.

The Draft Environmental Statement inappropriately referred to the stimated 400 tons per day of possible dust loss from a 1-million-barrel-per-day operation as "fugitive dust." As normally defined, "fugitive dust" is solid airborne particulate matter and 400 tons per day of airborne dust will not be generated from a 1-million-barrel per day industry. The estimated 400 tons of dust per day

refers to all dust "lost" from process streams, most of which is in the form of "dirt spills" which lay on the ground and are periodically picked up and returned to the process, or disposed with processed shale.

True airborne particulates are controlled by water sprays, wetting agents, covered conveyors, and dust collectors. For a typical 50,000-barrel-per-day plant, Colony Development Operation estimates from their experience that the dust collectors at the primary and secondary crushers, which are the major sources of fugitive dust, will emit an average of 400,000 cubic feet per minute, with a dust loading of approximately 0.01 grains per cubic feet (22,700 micrograms per cubic meter). This is equivalent to a particulate emission rate of 35 pounds per hour. At this rate of emission, Colony states that "all dust collector stacks would be clear." (See Volume I, Chapter I, Section D.5.)

Colony also estimates that fugitive dust carried in the 2 to 3 million cubic feet per minute of ventilation air exhausted from an underground mine serving a 50,000-barrel per day operation will amount to 20 pounds per hour with relatively short-lived increases to 60 pounds per hour immediately following each of the three blasting operations each day. A reasonable estimate for average fugitive dust emission from mining appears to be about 25 pounds per hour in an air flow of 2.5 million cubic feet per minute (2,650 ug/m^3), with maximum concentrations for short periods of blasting reaching 8,000 ug/m^3. Airborne particulates from a surface mine

would be expected to be somewhat less, since no positive air flow would be needed, in contrast to underground mining where positive ventilation is required.

Besides the above sources of airborne particulates - the crushing/screening plant and the mining operation - conveying operations between the crushing plant and retorting plant and possibly the spent shale handling system prior to adding moisture would contribute to airborne particulates. However, such miscellaneous sources should be minimal, as true airborne particulates. However, such miscellaneous sources should be minimal, as true airborne particulate pickup would occur only to the extent that natural air flow across belts, transfer points, and the like occurred. Conveyors and transfer points would be protected by hoods and collection equipment. An estimated 20 pounds per hour of miscellaneous airborne particulates is considered an appropriate allowance.

Based on the above data and estimates, the total emission of fugitive dust from a 50,000-barrel per day operation may be expected to approximate 80 pounds per hour or about 1 ton per day, a rate that would be within applicable State standards.

The total airborne dust emitted over the three-State area from a 1-million barrel per day shale industry would be expected to approximate 20 tons per day, but may be as much as 100 tons per day from all sources, including dust created by vehicles and that which may be picked up from disposal areas.

4. Overburden Dust, Dust Composition

Concern was expressed over the amount of airborne dust which might result from wind erosion of overburden storage piles and information was requested on the composition and physical size of particulates (7, 19, 226).

Response

In the initial years of surface development, it is necessary to transport the removed overburden to an off-site storage area. As the pit reaches sufficient size in later years, overburden can be disposed of directly in the mine. The off-site overburden storage area will require moistening and some compaction to minimize wind erosion. The amount of airborne dust from wind erosion of overburden storage piles cannot now be specified, but allowance has been made for this source in estimates of total airborne dust given in Response 3. The particle size of the overburden is substantially the same as in its natural state, where it does not wind erode.

Most particulate matter subjected to dusting will be either raw shale or processed spent shale. The chemical composition of raw shale is shown in Volume I, Table I-1, and a typical composition of one type of processed spent shale (that from a gas combustion retort) is given in Table I-6. Particle size varies widely with the processes involved, and can range from a fine powdery material to up to 10 inches in diameter.

5. Inversions, Regional Air Impacts

Information was requested on temperature inversions, which are common particularly in the Piceance Creek Basin of Colorado, and their contribution to increased air pollution, and also on the cumulative impact of several oil shale plants and associated industrial activities in a given locale (14, 19, 226, 229, 258, 288).

Response

The deep valleys on the south side of the Piceance Creek Basin experience temperature inversions, usually at night, and most commonly in midwinter. These diurnal inversions ordinarily do not persist over long periods (usually less than 24 hours). Regional dispersion studies will guide plant and stack locations, thus mitigating the impact from process emissions. A dispersion study was conducted for the prototype sites, the results of which may be found in Volume I, Chapter III, Section D. In addition, Battelle-Northwest Institute is conducting dispersion studies for Colony Development Operation. In September 1971, the Colorado Department of Health expanded its air sampling network in western Colorado to include Meeker, Rangely, Rio Blanco, and an Equity Oil Co. site near the Project Rio Blanco emplacement well. Additional monitoring will be conducted as a requirement of prototype development on public lands.

The area has an average of 20 days per year of inversion conditions. During these periods pollutants are trapped and may build to high concentrations, even approaching the stack gas composition. When the inversion breaks, due to changes in weather conditions or due to the natural heating-cooling cycle of the region, these

pollutants can reach ground level due to air currents and stay at high concentrations for short periods (hours) before dispersal. Repeated many times during each of the years the plant is in operation, such short-term impacts could cause cumulative adverse effects in highly localized areas. The areas affected are dependent on actual plant location, wind speed and direction, and factors involved in the inversion collapse. Inversions would not increase the total air pollution load, but would concentrate adverse effects.

The cumulative effects on air quality from more than one oil shale plant are directly related to the control technology used, location, plant site meteorology, regional and local air movements, inversion frequency and duration, and other non-shale sources of air contaminants. It is not possible to project the location of each oil shale complex and related non-shale industrial complex at the present time. The oil shale plants themselves will not be contiguous, since at least 5,000 acres of resource is needed to support a single plant, and probably an even greater area will be required as second and third generation plants increase in size. The addition of increasing numbers of plants in any given locale will itself lead to cumulative effects. As discussed in Volume I, Chapter III, Section D, however, if these plants are no closer than 15 miles, the probability of synergistic effects is low, except under inversion conditions.

6. Gaseous Emissions; Spent Shale Disposal

The Statement does not consider gaseous emissions that may present problems in spent shale disposal areas (7).

Response

Pyrolysis is an efficient means of converting oil shale to shale oil and nearly all volatile hydrocarbons are converted. It is doubtful that processed shale contains residual amounts of volatile hydrocarbons or other chemical compounds of sufficient quantity to be significant air contaminants. However, a study currently in progress by Denver Research Institute is examining the potential concentrations of these contaminants from a typical processed shale pile.

7. Noxious Gases Associated with Mining

A request was made for identification of noxious gases associated with room and pillar mining operations. Are they explosive? Asphyxiate? Flammable? Could the presence of diesel trucks, explosives, or dynamite cause the gases to explode (31)?

Response

To date, no known noxious or flammable and explosive gases (such as methane) have been found in room and pillar mining of oil shale. However, the deep oil shale formations may encounter gas, and if it is found to exist, the equipment and mining method must, by law, provide for safety of operations. The major noxious gases of real concern would be those arising from operation of equipment and

explosives underground. With proper control, as provided by law, there would be little or no danger of gas, if it occurs, being exploded by diesel trucks or explosives.

8. Sulfur Standards for Fuels Combustion

The sulfur standard for fossil fuel-fired steam generators is 0.6 lb/million BTU which is the sulfur standard if fossil fuel is burned. The sulfur standard for liquid or gaseous fossil fuel in power plants is 0.4 lb/million BTU (40 CFR 60.43). It should be noted that these sulfur standards only apply to fossil fuel-fired steam generating units of more than 250 million BTU/hour input (7).

Response

The comment is correct, but the approach used to assess the impact on air quality has been refined since the draft statement was released. The Final Statement discusses the air pollution potential from stack gases in Volume I, Chapter III, Section D, including discussion of sulfur oxide emissions as a function of the gaseous fuel. Assumptions are made that the gases available from "internal combustion" retorting processes are combusted as low BTU fuel gases and that those from "indirectly heated" retorts are combusted as high BTU fuel gases. The discussion shows that the estimated concentration of SO_2 in resultant stack gases would be difficult to control but would be controllable by either treating the gas prior to combustion or the resultant stack gases to within applicable State and Federal emission standards. In

addition, the air quality sections above discuss the dispersion of SO_2 and other gases and predictions are made of ambient ground level concentrations, and the possible impacts on humans, animals, and vegetation.

9. Design Data; Air Quality Control

Despite the fact that the chemistry of NO_x formation is not completely understood, control methods and specific design data should be described in the Final Statement (7).

Response

Alternative methods of control are discussed in Volume I, Chapter III, Section D. However, detailed plans for the control of oxides of nitrogen and other pollutants will probably not be available before a potential developer has filed for the permits required under law.

10. Differential Thermal Absorption of Carbonaceous Spent Shale

The differential thermal absorption of carbonaceous spent shale dumps could cause large areas of land to have a higher thermal content than the surrounding environment, thus affecting the micro-climate and possible thermal air convection over large areas (7).

Response

The texture and color of "spent shale" will vary widely with the retorting process. Material which is very dark and fine-grained, such as "processed shale" from the TOSCO II retort, might be expected

to be a problem in this regard. However, experience of the Colony Development Operation has not thus far shown it to be so. Surface temperatures of the processed shale reach 77° (See Volume I, Chapter I, Section D.1.b). While its color is darker than many natural soils, there has been no signficant chimney effect observed. The exposed surface area in active disposal sites are expected to be relatively small. Covering with mulch or native soil material will largely eliminate the color contrast with the surrounding area as will the establishment of vegetative cover. Regular application of irrigation water during the revegetation process will also provide a cooling and distribution effect. Shade effect from established vegetation and development of plant litter will likely assist in normalizing the heat absorption characteristic of spent shale disposal sites. Thus, neither significant changes in the microclimate nor thermal convections over large areas are expected.

E. Fauna

The Final Environmental Statement includes detailed treatment of this topic area. The reader is referred to the sections listed below for data on the relationship of oil shale development to fauna:

Vol. I	Chapt. II	Sec. A.6, Sec. B.6 Sec. C.6, Sec. D.6
Vol. I	Chapt. III	Sec. E.2.a, Sec. E.2.b Sec. E.2.c, Sec. E.2.d Sec. E.2.e, Sec. E.2.f Sec. E.2.g, Sec. E.2.h Sec. E.3.a, Sec. E.3.b Sec. E.3.c, Sec. E.3.d
Vol. I	Chapt. V	Sec. E
Vol. I	Chapt. VI	Sec. E
Vol. III	Chapt. II	Sec. B.1.e, Sec. B.2.e Sec. B.3.e, Sec. B.4.e
Vol. III	Chapt. IV	Sec. D
Vol. III	Chapt. VI	
Vol. III	Chapt. VII	

1. Ecological Interrelationships

The ecological evaluation within the statement is inadequate, and, as a consequence, the evaluation is misleading (7, 23, 38, 42, 44).

Response

In some sections of this Statement, fauna are discussed in biotic categories, such as birds and mammals in Volume I, Chapter II, since this is the most logical way to present descriptive data. In other sections, such as Volume I, Chapter III, discussions are categorized into groups of impact (access, disturbance, loss of

habitat, erosion, etc.). The latter approach was selected as the most practical method of presenting the complex program impacts upon fauna. Regardless of how the materials are organized, a technical difficulty will persist in cogently interrelating all species and other faunal variables for all the impacts considered, since each impact would affect different species in varying ways. In order to provide a more ecologically integrated discussion, the impact discussion of fauna in the Final Statement, Volume I, Chapter III, Section E, has expanded in a number of places to provide more specific examples of ecological interrelationships.

The proposed lease stipulations, presented in Volume III, Chapter V, provide that each lessee shall monitor appropriate environmental parameters, under Departmental supervision, over a period of at least 2 years, at least 1 year of which shall be prior to submission of the detailed mining plan, in order to establish a base line of data on the existing environment. Included will be studies of the distribution, abundance, and ecological interrelationships of flora and fauna of the leased lands and adjacent lands within a mile of the leased lands.

2. Regional Impact; Decrease in Wildlife Populations

The regional impact on fauna due to increased development activities needs to be clarified (38, 42, 47).

Response

The Final Statement contains specific biological, physical, and socioeconomic references to program-related impacts beyond the six proposed lease tracts. These included impacts on regional water

resources, fauna, recreation, socioeconomics, and others. Additional descriptive material on rare and endangered species, existing faunal populations, hunting pressure, and value is presented in Volume I, Chapter II; an impact analysis on air pollution, rare and endangered species, poaching, and potential impacts upon regional fish and wildlife management programs is set forth in Volume I, Chapter III, Section E.

In general, the native fauna of the oil shale region would react to industrial development and urbanization in the same way fauna have reacted to the pressures of expanding population and land development in other parts of the United States. Species such as mountain lions, elk, large raptors, and grouse which, because of unique behavioral traits, are intolerant of human activity, will retreat from the area, and their numbers will be reduced by the loss of available territory. Deer herds will be reduced for the same reasons, but, being more tolerant, they will not retreat as far. Increased interference with their migratory routes will tend to favor those animals that do not migrate and alter the behavior of the herds over time. Losses of native fauna can be related to the level of development and the populations of intolerant species will be reduced. More tolerant species and species which utilize smaller territories will also be reduced in numbers, mainly by the physical loss of habitat and the impact of introduced pollutants such as dust, pesticides, polluted waste water, and noxious effluents from industrial processing.

Water development associated with industrial and urban development will have a significant impact on these populations. Reduced flows in natural river courses would reduce the value of downstream aquatic and ripairan habitat. Losses of native fauna and changes in relative numbers of particular species, especially aquatic and riparian species, would be similar to those resulting from other water diversion projects in western States.

The Statement recognizes and examines the net loss of both fauna and their habitat which would occur on both a local (Volume III, Chapter IV, Section D) and regional basis (Volume I, Chapter III, Section E).

3. Ripple Effect

The total combination of impacts will create a pronounced "ripple effect" - repelling many species of wildlife from an acreage well in excess of the acreage physically disturbed. An insufficient effort has been made in the Statement to determine the extent of this large zone of impact - either around the individual lease tract or in the broader developed areas (38, 283).

Response

Although not referred to as a "ripple effect," the potential for less direct effects of development on lands and waters surrounding the oil shale tracts is recognized. Discussion of the components of this effect can be found in Volume I, Chapter III, Section E, and Volume III, Chapter IV, Section D of the Draft Statement. For example, reference is made to: local increases in hunting pressures and other human uses; loss of primitive qualities as a result of visual and audio impacts of roads, pipelines, and air traffic; stress and disturbance to normal

wildlife and behavior patterns, with resulting avoidance of affected zones; recognition that there would be continuous stress experienced by wildlife in the tract vicinity; and changes in natural plant-animal complexes due to drying of springs and other surface water features with resultant altered distribution of animals.

4. Adequacy of Faunal Descriptions

Additional data and quantification on endangered species, the food chain, insects, and other invertebrates, amphibians, reptiles, small mammals, hawks and owls, and fish population were requested (2, 23, 25, 32, 38, 42, 44, 47, 52, 74, 79, 88, 138, 159, 160, 167, 189, 202, 236, 242, 246, 250).

Response

Quantitative information is available mainly for economically significant species, such as mule deer. Although less information is available on small mammals, reptiles, and invertebrates of the area, additional information covering a broader spectrum of species has been included in the Final Statement in Volume I, Chapter II.

5. State Fish and Game Agency Inputs

Additional input from the State game and fish people is needed to account for the small game populations (250).

Response

Most of the faunal information in the Draft Statement was obtained from State Fish and Game Agency personnel and publications. In preparation of the Final Statement, requests were made of these agencies for additional data which are reflected in the Final Statement in Volume III, Chapter II, and Volume I, Chapter II.

6. Wild Horse Populations

The Statement fails to include adequate quantitative treatment of the impact of the proposed oil shale development on wild horse populations (38, 96).

Response

Additional quantitative data on the wild horse populations of the oil shale lands were received during the public review and have been included in Volume I, Chapter II and Volume III, Chapter II. Development would result in a loss of wild horse range and browse, as well as alteration of established movement patterns, as discussed in Volume I, Chapter III, Section E.

7. Inventories of Rare and Endangered Species

Inventories of presently rare, endangered, and threatened species are incomplete, and impacts on these species, including those that extensive development might push to rare, endangered, or extinct status, have not been adequately considered (2, 6, 13, 25, 32, 38, 138, 167, 198, 250, 268).

Response

Additional information on populations of endangered and threatened species of the oil shale lands and potential program impacts upon them has been added to the Final Statement in Volume I, Chapters II and III and Volume III, Chapters II and IV.

8. Riparian and Aquatic Communities

Two ecological communities have not been considered in the Statement: (1) riparian (or stream terrace) communities, and (2) aquatic communities (38).

Response

Although they were not specifically termed riparian and aquatic communities, the Draft Statement did consider impacts on these communities in Volume I, Chapter III. Additional descriptive material has been added to the Final Statement in Volume I, Chapter II, and the appropriate impact sections expanded in Volume I, Chapter III.

9. Projections on Hunting and Angling Pressures

Projections on hunting and angling pressure should be rewritten and structured by individual States. As written, the Statement combines all three States, which obscures the information. Pertinent facts should include jurisdiction and management of wildlife, including the hunting regulations of individual States (25, 189, 250).

Response

The projections in question were taken from the Upper Colorado River Basin Comprehensive Framework Study referenced in Volume I, Chapter III, Section E. The Draft Statement did consolidate the statistics, and incorrectly stated that, without oil shale development, a net surplus of both hunting and angling supply would exist in the year 2000 in all three States. Actually, the study projects a hunting deficit in Wyoming by the year 2000. These projections have been drafted by State in Section E, referenced above.

As pointed out in the comment, the States exercise exclusive jurisdiction over, and management of, all resident wildlife except endangered species.

10. Recreational Hunting Expenditures

Mule deer and other species generate the expenditures of hunting-related dollars which should be considered (23, 38, 189).

Response

The Final Statement has been expanded to include additional statistical information on expenditures by sportsmen in Volume I, Chapter II.

11. Adverse Fishery Impacts

It is impossible to relate the probable stream degradation and probable water table drawdown to the downstream fish population and the effects thereon (23, 44, 88, 245). The impact of increased salinity and consumptive use of the headwaters of the Colorado River system on fish, related organisms, riparian biota, and rare and endangered species is not adequately assessed (23, 38, 52, 245).

Response

The presently available information on aquatic forms downstream from the oil shale lands, including rare and endangered species, is contained in Volume I, Chapter II, of the Final Statement. The broad range of possible aquatic impacts due to oil shale development are discussed in Volume I, Chapter III, Section E and Volume II, Chapter IV, Section D of the Final Statement, including the impacts of disruption of ground water patterns, erosion, increase in salinity due to water consumption and salt loading, and degradation of water quality due to oil losses, sewage, toxic substances, and siltation. Oil shale development will contribute some pollutants, and therefore degrade the environment. This degradation will cause some reduction in the quantity and quality of these resources as discussed in the Final Statement.

12. Critical Winter Deer Browse

Existing summer range is more than adequate for existing populations of mule deer, but the number of deer is governed by the amount of available winter range (7, 38, 42, 44, 283).

Response

The availability of browse on wintering ground is a limitation on the number of mule deer on the oil shale lands. Plant species, such as mountain mahogany, serviceberry, sagebrush, and bitterbrush, provide the food base by which the deer survive the critical winter period. Loss of such habitat as a result of oil shale development will reduce the deer population. See Volume I, Chapter III, Section E, of the Final Environmental Statement.

13. Wildlife Habitat Loss

Physical habitat loss to animals, such as mountain lions, elk, peregrine falcons - endangered species - and prairie falcons could be up to 20,000 acres per year. Over 30 years, this would amount to 600,000 acres, which, when subtracted from 805,000 acres, leaves only 205,000 acres for their remaining habitat. From these facts, it can be assumed that these animals would be completely lost from the area as they could not withstand this kind of pressure for such a prolonged period of time (50, 283).

Response

The calculations set forth in the comment above are incorrect (See Volume I, Chapter III, Section A). Assuming a 1-million-barrel-per-day industry, a maximum of 80,000 acres of land in the three States of Colorado, Utah, and Wyoming would be cumulatively affected over the first 30 years. This estimate includes the land required for mining, processing, waste disposal, utility corridors, access road and related urban development. A decrease in wildlife populations as the result of habitat acreage loss will occur as has been recognized in the Final Statement (See references cited in 2 above).

14. Restoration of Wildlife Habitat

A number of comments (23, 26, 38, 43, 50, 120, 250, 283) questioned the adequacy of the treatment of restoration of vegetation as it relates to fauna. Specific comments questioned the ability of revegetated plants to survive natural range conditions; pointed out that experimental plant species cited in the Draft Statement include more nonnative than native species; stated that major native deer browse species, such as mountain mahogany and bitter brush, have never been successfully replanted in large quantities; questioned whether experimental work done to date will be broadly applicable; and stated that the time required for revegetation is not consistently explained and that information on revegetating native plants is deficient.

Response

A more complete range of applicable studies on revegetation have been considered in Volume I, Chapter I, Section D, and the applicable impact analyses in Volume I, Chapter III, and Volume III, Chapter IV, have been revised. As indicated in the chapters referenced above, a considerable body of information is available which indicates that revegetation on native soils can survive under natural range conditions. Relatively successful cover establishment can be anticipated on disturbed native soils in areas such as utility corridors, roadside cuts, and similar circumstances. However, this research is not broadly applicable to revegetation of processed shale and deeply disturbed parent soil materials. Such information is rather limited, research having emphasized grasses with only limited

attention having been given to forbs and almost no long-term studies on shrubs. Thus, the optimum selection of species, germination and survival rate, and expected density of cover have not yet been fully established nor can the future pattern of succession be predicted with certainty.

Establishment of initial cover and successional change on processed shale disposal sites will be constrained by the plant growth media and the semi-arid climate, exposure, slope, and cultural practices, including temporary irrigation and fertilization. While it is true that most of the experimental work has used more non-native than native species, research now under way by Colony Development Operations and Colorado State University are directed toward establishment of native browse species such as mountain mahogany. Existing information indicates that artificial reestablishment of the full preexisting complex of native browse and cover species, such as mountain mahogany, serviceberry, sagebrush, and bitterbrush on spent shale areas may not be feasible except over extended periods of time. The reestablished vegetation complex may be used by a different cross section of animal species than originally inhabited the area, and it may not be as productive to all native animal species as was the original complex. A new complex, however, could be productive for certain uses, such as cattle grazing.

The confusion about time relates to the general planning schedule assumed for reclamation of disturbed areas. A 3-year conversion period was selected as an assumed average period needed to establish some vegetative cover. It is recognized that climatic and

soil conditions will vary from area to area and that where revegetation fails, it will be repeated to establish cover of a similar type and equal in quantity and quality to that which was destroyed or damaged. However, reestablishment of the full range of wildlife habitat will require extended time periods, e.g., from 20 to 70 years. One of the objectives of the prototype program is to develop the technology needed to restore wildlife habitat and demonstrate the feasibility of such restoration.

15. Reestablishment of Wildlife Populations

Information in the Statement relating to reestablishment of wildlife populations is unclear. In light of known problems, reestablishment of wildlife populations, as anticipated by the Statement, must be adequately documented and made part of the permit system (38).

Response

Reestablishment of faunal populations would occur in a natural manner and the rate and quality of such reestablishment would be dependent upon the success of habitat restoration and mitigation. As the land revegetation and rehabilitation measures are implemented and as the various forms of human disturbance decrease on the affected lands, repopulation with native animals, through immigration from surrounding habitat, would be expected to occur on suitably restored habitat. Specific provisions for reestablishment of wildlife populations is not provided in the prototype program, although the fish and wildlife management plan required for each prototype tract (Volume III, Chapter V) may include such provisions for species which present special problems for reintroduction.

16. Erosion

The hazards of erosion can be minimized by strict revegetation standards. It is not clear that fish spawning and nursery areas are in or adjacent to lease areas and how precisely such areas would be affected by erosion (43, 58).

Response

Erosion can be minimized throug revegetation, which is required by the lease stipulations (Volume III, Chapter IV) and various other techniques. However, erosion control is often subject to significant limitations. For example, in the time between construction and re-establishment of vegetation, exposed land is vulnerable to erosion. Frequently, combinations of drainage, slope, soil composition, and other factors result in erosion problems which are difficult to control.

Siltation and sedimentation of streams can have several adverse impacts on fish in the immediate area and downstream, including destruction of spawning sites, smothering of eggs, reduction of adult populations because of increase of stress by direct effects and loss of food organisms adversely affected by the silt. The impacts expected to be associated with prototype development are considered in Volume III, Chapters IV and VI.

17. Off-Tract Disposal Sites

The potential wildlife losses associated with off-tract disposal sites was requested (38, 283).

Response

The mode of spent shale disposal has not yet been decided for any of the tracts, although the alternatives of off-tract, on-tract,

underground disposal, as well as various combinations of the three, were considered. The actual mode of disposal cannot be ascertained until a lessee has submitted his plan of operations. However, additional details of the environment of the hypothetical disposal sites used in this analysis have been provided in Volume III, Chapter II. In addition, the amount and types of wildlife food and cover destroyed both on- and off-tract have been estimated (Volume III, Chapter IV, Section A). Estimates of the potential wildlife losses given in both Volumes I and III include those associated with off-tract disposal.

18. Tract Selection

Several comments were adverse to the selection of Colorado Tracts C-a and C-b (26, 38, 43, 50, 189, 283). These comments included: (1) selection of the two Colorado lease tracts is not consistent with the program goal of minimizing adverse environmental impacts; (2) alternative methods and attractive sites are available which would be less destructive and far more beneficial to the environment; (3) development of Tracts C-a and C-b is incompatible with continued large deer population; and (4) C-a is on the migratory route of the deer herd.

Response

Selection of Tracts C-a and C-b was based on a comparative evaluation of various resource development and environmental factors (See Volume III, Chapter IX, Section H). As discussed therein, their selection is consistent with the program objective of stimulating

commercial scale oil shale production and technology while minimizing adverse environmental impacts. However, development of either tract will destroy wildlife habitat and, in combination with accompanying industrial activity, will reduce the wildlife value of the tracts and surrounding areas. While this will adversely affect the deet population, it cannot be said that development at Tract C-a and/or C-b is incompatible with the continued existence of large deer populations in the basin. As discussed in Volume I, Chapter III, Section E, losses will increase should a mature industry develop.

Tract C-a also lies in the area traversed by mule deer migrating to winter habitat in the Piceance, Yellow Creek, and White River drainages. In some areas, there is evidence that highways transecting the traditional migration routes of the White River herd have altered migration behavior; fewer deer migrate to the high summer range and, consequently, more deer stay in the Piceance Basin throughout the year. Development of Tract C-a will result in adjustments in behavior and rerouting of the traditional deer migration pattern.

19. Withdrawal of Critical Wildlife Tracts

The Bureau of Land Management should have the opportunity to permanently withdraw from development certain BLM tracts critical to wildlife in addition to the lands listed in Chapter IX, Volume I, of the Statement. Such areas could be designated as BLM primitive, natural, geologic, etc., areas as appropriate - or perhaps designated as national wildlife refuges, such as Piceance Basin National Deer Refuge (38).

Response

There are established procedures for setting Federal lands aside for wildernesses, parks, recreation, wildlife, or other special purposes. The oil shale lands have for many years been and will continue to be withdrawn from disposal and most forms of development. Executive Order 5327 of April 15, 1930 withdrew all oil shale lands for purposes of study and classification. The only general modifications of that withdrawal have been to permit oil and gas and sodium leasing. Modifications for specific purposes on individual tracts such as will be required to permit the prototype leases have also been effected from time to time. Except for the 6 prototype leases, the status of the remaining oil shale lands will be unchanged. Areas of special value meriting further protection can be further classified or set aside if identified. A recent example of such action on the general area although not on oil shale lands is the designation of the Gunnison Gorge Recreation Area in nearby Delta County, Colorado.

20. Air and Noise Quality

The interrelationships of air quality and noise levels with the living resources are not adequately discussed (2, 19, 42).

Response

The effects of noise are treated in the Final Statement in Volume I, Chapter III, Section E. Noise is included as part of a broader group of disturbing factors (varying types of construction work, vehicle traffic, and human activities in general), and these factors would be expected to place stress on wildlife as described in the material referenced above.

Sulfur oxides, oxides of nitrogen, carbon monoxide, and, to a lesser degree, hydrocarbons would be released from stack emissions. The adverse effects of these pollutants on humans, animals, and vegetation are detailed in Volume I, Chapter III, Section C.

21. Poaching

Discuss poaching of wildlife (23).

Response

Poaching, along with other infractions of game laws, human encroachment on fish and wildlife populations and habitat is discussed in the Final Statement in Volume I, Chapter III, Section E.

22. Need for Additional Fish and Wildlife Management

Fish and wildlife management practices, relative hunter success, and other variables must also enter into any evaluation of impact. The impact of increased population indicates a need for added enforcement of game and fish laws and increased personnel (25, 79, 250).

Response

Impacts of urbanization and increased human population on both the quantity and quality of hunting and angling are recognized and the effect these impacts may have on fish and wildlife management of the oil shale region are described in Volume I, Chapter III, Section E.

23. Laws and Treaties

The Draft Statement fails to comply with the intent of five Federal laws and two international treaties, each of which calls for protective measures on behalf of wildlife (38). Cited laws and

treaties include: Endangered Species Act of 1966 (P.L. 89-669, 80 Stat. as amended); Bald Eagle Act of 1942 (54 Stat. as amended); Golden Eagle Act of 1962 (P.L. 87-884); Wild Horse and Burro Protection Act of 1971 (P.L. 92-194); 1916 Convention between the United States and Great Britain for the protection of migratory birds; 1937 Convention between the United States of America and the United Mexican States for the Protection of Migratory Birds and Game Mammals; and the Migratory Bird Treaty Act of 1918 (40 Stat. 755, as amended).

Response

The Statement's description and analysis of the possible adverse impacts of the proposed program upon species and habitat protected by the cited laws and treaties violates neither the letter nor intent of those laws and treaties. Implementation of the proposed program is not expected to adversely affect continued compliance with and enforcement of those laws and treaties. Moreover, the program includes in Volume I, Chapter IV and Volume III, Chapter V, measures designed to avoid or minimize adverse effects upon the applicable species and habitat. The cited laws and treaties were not intended to preclude development and use of the Nation's natural resources.

24. Short-Term Use vs. Long-Term Environmental Productivity

The Statement fails to adequately assess the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term environmental productivity (38).

Response

This relationship as it concerns fauna, is considered in Volume I, Chapter VI, and in Volume III, Chapter VIII, of the Final Statement. In these sections, it is estimated that the expected short-term uses of oil shale would adversely affect the long-term productivity of the regions' faunal resources and change the nature of the native fauna. Through pursuit of balanced mitigation programs unavoidable adverse aspects of the development can be reduced but not eliminated. However, shifts in species composition are expected on restored areas at least over the short-terms.

25. Impacts of Multiple Development

Information on other existing and proposed developments in the oil shale region--nuclear gas stimulation, the mining of dawsonite, nahcolite and coal, and gas and oil should be added to that provided for oil shale development. The combined impact of these multiple developments poses an even greater threat to fish and wildlife of the three-State region than would oil shale development alone (38).

Response

Within that portion of the upper Colorado region in Colorado, Utah, and Wyoming containing the Green River Formation oil shale, there are additional mineral deposits of significance. Saline minerals (dawsonite, nahcolite, and trona) are in or associated with the oil shales. Crude oil and natural gas underlie the deposits and coal is immediately adjacent. Trona, crude oil, natural gas and some adjacent coals are currently being developed on a commercial basis

(See Volume I, Chapter II). Technology for processing nahcolite and dawsonite has not yet been demonstrated as discussed in Volume I, Chapter I, Section C. A single nuclear gas-stimulation experiment, Project Rio Blanco, has been conducted in the Piceance Creek Basin (May 1973). Other than disturbance, there is no evidence of direct effects on fauna in the immediate area of the test (Fawn Creek). However, some secondary effects did occur, for example, local slides covered barrow holes destroying some habitat.

The timing, location and magnitude of non-oil shale mineral development in the three-state area cannot now be predicted. Likewise, the possible environmental effects of such development cannot be assessed in this Environmental Statement. In any event, it is reasonable to assume that non-oil shale industrial development would have a greater impact on the resources of the oil shale region, including fish and wildlife, than would oil shale development alone.

26. Ecological "Triggering Mechanisms"

The impact of each alteration on the oil shale regional ecosystem must be analyzed as thoroughly as possible. For example, "fugitive dust" may destroy certain plant species which in turn may affect wildlife browse, hydrological factors and erosion. The ecological "triggering" mechanisms are not analyzed to any significant degree in the Draft Statement (42).

Response

A complex web of interrelationships that now exist in the oil shale regions would be altered by oil shale development. The major ecological "triggering mechanisms" have been recognized in the environmental statement although not always identified by that nomenclature. They include: (1) fugitive dust effects on plants and animals dependent upon those plants; (2) erosional effects set in motion by mechanical or other destruction of vegetative cover, and the resulting sedimentation, water quality reduction and losses of fish, wildlife, and other stream biota; (3) possible air pollution effects on plants and animals and related effects on large and small game and related small animals and birds; (4) plant successional changes resulting from revegetation efforts and the potential related impacts thereafter upon wildlife, soil holding capability and erosion; and the related erosional effects already mentioned; (5) general effects of development, including noise, causing disturbance and population dispersement, competition for habitat, ultimate population loss and related hunting effects; (6) possible introduction of toxic

materials into water with possible cumulative distribution throughout the fish and aquatic biota food chain; (7) effects of intensified human population concentration, road development and construction, including disturbance, displacement, and loss of wildlife such as intolerant species like mountain lion, eagles, bear, elk, and related effects on predator/prey wildlife relationships; (8) ground water changes that might result in changes in flow and surface release of ground waters and the effects this could have on riparian plant and animal habitats; and (9) introduction of native or non-native plant species and related effects on successional patterns, weed characteristics, and ground cover maintenance (requiring different water and fertilization and regimes), all of which would alter the vegetative conditions and microclimate for small animals, birds, invertebrates, and soil building and structure, among others.

It is recognized that the tolerant plant and animal species tend to adapt in many instances and adjust to a new and different environment, that populations and dependencies will change, as well as the usefulness of some species to each other because of the total impact on a primitive environment.

27. Opposition to Use of Herbicides and Pesticides.

Opposition to the use of herbicides and pesticides was expressed (23).

Response

An environmental stipulation regarding the use of herbicides and pesticides is included in the Lease and Stipulations (Stipulations, Section 7(E)). This stipulation states that the lessee shall not

use pesticides and herbicides without the approval of the Mining Supervisor. Furthermore, the stipulation states that the use of these agents shall be considered as "treatments of last resort" to be used only when reasonable alternatives are not available and where their use is consistent with protection and enhancement of the environment. Application, storage, and disposal shall be in accordance with applicable Federal and State procedures.

28. Effects of Water Development Projects

The statement does not discuss the impacts of water development projects necessary for oil shale development and their effect upon wildlife. These may or may not be more detrimental than mining, itself, but the combined effect will be disastrous (23).

Response

Large scale water development projects are not believed to be necessary for the proposed prototype program although some diversion of surface water was recognized (See Volume III, Chapter IV, Section B). Future development projects may be needed to support mature oil shale development, but it is difficult to address definitively the impacts of any such water development projects without detailed information as to number of impoundments and/or diversion projects, location of dams, acreage and types of habitat to be inundated, and magnitude and seasonality of expected water level fluctuations. In general, impoundments will inundate existing terrestrial habitat. The severity of resulting impacts on wildlife will depend on the type of habitat affected. Moderate effects would be expected in arid, rugged canyon-type habitat, and more

severe effects in forest, meadow, or marsh type habitat. In the case of aquatic organisms, impoundment results in a dramatic change from a river to lake type habitat, with accompanying loss of current and changes in temperature, depth, turbidity, and, usually, dissolved oxygen content. These changes are usually accompanied by dramatic changes in species composition.

F. Forage and Revegetation

The impacts on grazing and agriculture due to oil shale development is given in Volume I, Chapter III, Section F; Volume I, Chapter V, Section F; Volume III, Chapter II, Section B.1.g, Section B.2.g, Section B.3.g, Section B.4.g; Volume III, Chapter IV, Section E, and Volume III, Chapter VI.

Revegetation of disturbed surfaces and of processed shale disposal areas is discussed throughout Volumes I and III. See, in particular, Volume I, Chapter I, Sections D.2 to D.4, Chapter III, Section B.4, and Volume III, Chapter IV, Section A.5.

1. Reduction in Forage; Revegetation Technology

Oil shale development will result in a loss of forage for both domestic stock and wildlife. The magnitude of this loss during the active phase of this industry should be discussed as well as a better description of the technology needed to restore these areas to their former production (2, 3, 12, 18, 23, 25, 26, 30, 36, 38, 42, 43, 44, 79, 120, 127, 137, 154, 168).

Response

The amount and type of vegetation which would be destroyed or otherwise damaged by development has been estimated for each of the proposed prototype tracts (See Volume III, Chapter IV, Section A). These estimates provide the basis for the estimates of grazing foregone by oil shale development given in Section E, Chapter IV of Volume III. The broader range of impacts on vegetation and grazing associated with regional development is discussed in Volume I, Chapter III, Section F.

Revegetation technology is considered in Volume I, Chapter I, Section D (See also response to comment E.14, above).

The existing vegetative complexes of these areas have evolved over long periods of time. The species and species groups are interdependent and in a reasonable degree of natural balance and stability. The natural balance between species and groups of species will be altered in some processing options (for example, in situ processing) or completely destroyed on others, such as mine development and processed shale disposal areas.

In general, revegetation can be initiated on such disturbed areas as soon as the activity is terminated. The nature of the resulting new plant communities and the pattern of the ensuing successional changes will also vary distinctly from site to site depending upon site characteristics, types of disturbance, species planted, revegetation methods, and subsequent management.

If mixtures of native species, which include the major climax (or desired sub-climax) species, are used to revegetate disturbed native soils, natural progression may be relatively rapid. The planting of older age class shrub and tree seedlings could accelerate the establishment of more stable plant communities.

If exotic species are used, particularly as monocultures, successional changes will be much more extensive as the introduced species will eventually be replaced by natives beginning with aggressive invader species and ending with climax or "use-sub-climax" species. Exotic plant monocultures can survive for extended periods with adequate management. However, they are susceptible to severe setback by adverse climatic conditions and insect or disease

infections, destroying the cover and increasing erosion. Maintenance of non-native species would therefore require long-term management.

2. Interrelationship of Vegetation Types

The Draft Statement indicated that vegetation in the area is predominately of three major types: sagebrush, mountain shrubs, and pinyon-juniper. These vegetative communities are important factors and the interrelationship should be explored (2).

Response

The Final Environmental Statement describes the interrelationship between plant and plant/animal species. This additional information on bio-communities is contained in Volume I, Chapter II (see in particular Sections A.8 and B.8).

3. Revegetation of Processed Shale Piles - Tract C-b

A statement concerning Tract C-b in the Draft Statement (Volume III, Page IV-11) indicates that there is a possibility that revegetation of processed shale piles may not be required. Is this true? (23).

Response

No inference should be drawn that processed shale dumps on Tract C-b, or any other tract, will not be revegetated. The discussion for that tract concerns the percentage of the surface area containing top soil suitable for mixing or top dressing the shale piles for re-establishing vegetation on the processed shale dumps and the need for adequate fertilization and irrigation. Revegetation will be required as detailed in Volume III, Chapter V.

4. Revegetation - Continued Fertilization and Water Requirements

The Draft Statement does not state whether and to what extent growing vegetation on the waste piles of processed shale depends on continued fertilization and watering (39).

Response

Additional material relating to revegetation has been included in the Final Statement (See Volume I, Chapter I, Sections D.2, D.3, and D.4; and Volume III, Chapter IV, Section A.5). In these sections, methods of revegetation, watering requirements, and successional patterns following revegetation are discussed.

5. Spent Shale Compaction and Relationship to Revegetation

The tendency of spent shales to become compacted has not been adequately meshed with the necessity to provide permeability in the surface layers of spent shale to allow vegetation to grow (7).

Response

The tendency of spent shale piles to stabilize through compaction or cementation is a fortuitous characteristic from an engineering standpoint. It is not considered to be adverse to successful revegetation. If not covered by native soil, preparation of a seed bed on compacted shale would require cultivation of the upper foot or so after leaching, seeding, fertilization and mulching. As the plants mature, the roots have been found to penetrate the compacted zone to a depth of a foot or more. (See Volume I, Chapter I, Section D.2)

The discussion of cementation properties in Section D.1 of that same chapter should not be interpreted as stating that waste piles form a monolithic and essentially impenetrable layer, like concrete.

6. Lethal Temperatures; Germinating Seeds

Will the black color of unburned residue cause lethal temperatures for germinating seeds? (50)

Response

The black color could cause lethal temperatures for seed germination, particularly as it relates to the material produced by the TOSCO retort discussed in Volume I, Chapter I. One of the reasons for adding topsoil or other materials to the top layer of processed shale prior to revegetation is to avoid this potential problem.

7. Compaction; Effect on Salinization

Compaction of retorted shale subsurface layers could expedite the salinization process by restricting downward percolation of water through the root zone (50).

Response

This comment is probably correct. Over time it is expected that compacted shale will weather deeply as do other native soils, and that root penetration and frost heaving will improve soil aeration and soil formation.

8. Revegetation: Number of Attempts: Criteria

Will there be a limit on the number of attempts to revegetate and reseed? Who will determine whether or not a seeding and planting

attempt has been successful? What criteria will be used to determine success or failure? (7)

Response

No limitation on the number of attempts to revegetate and reseed, which would be required of a lessee, is specifically included in the proposed lease. The mining supervisor would determine whether or not a seeding and planting attempt has been successful, and whether all feasible technology and practice had been exhausted. (See Volume III, Chapter V, Stipulation 11(L). The cited reference also sets forth the criteria for determining success or failure.

All oil shale lessees will be required to initiate a revegetation program approved by the Mining Supervisor at the start of production and to delineate those parameters necessary to establish vegetation at a specific location and show the successional changes in vegetation. Also, lessees will be asked to demonstrate at the time of the detailed development plan that revegetation technology is available to enable him to establish revegetation of the disturbed areas. If a lessee fails to demonstrate the required technology, he will be required to submit for approval a program designed to obtain the required technology. The lessee will make annual progress reports to the Mining Supervisor on the approved program. If progress appears inadequate at any time, the Mining Supervisor may request the lessee to amend the program.

9. Revegetation; Brush Chaining

Brush chaining operations for changing a brush community to a grassland community are not comparable to revegetation of spent shale areas. The biological interrelationships are quite different (2).

Response

This comment above is correct. See the information contained in Volume I, Chapter I, Section D. For an overview of vegetation interrelationshops, see particularly Volume I, Chapter II, Section B.8.

10. Maintenance of Revegetation Areas After Program Completion

Who will maintain the revegetation projects after the oil companies have left? Who will ensure that erosion control projects are maintained (18)?

Response

Revegetation and erosion control measures will be designed insofar as possible to minimize long-term maintenance and produce vegetation capable of surviving under natural conditions. Decisions on future use of the lands will be a factor in these plans as well. Basically, the Bureau of Land Management will continue to have responsibility for the Federal lands and will continue multiple use management for these lands as with surrounding areas. The reclamation of the leased lands prior to termination of the responsibility of the lessee will require the lands to be in a condition which provides a similar use and maintenance as that found prior to the disturbance of the lands. The Bureau of Land Management will be responsible for assuring that such conditions exist prior to termination of the lease. Subsequent to lease termination, the Bureau of Land Management will be responsible for any erosion control and revegetation programs that may be required.

G. Esthetics

Discussions of archaeological and historical values are located in Volume I, Chapter II, Section B.10 and Section C.11; Volume II, Chapter II, Section B.1.j, Section B.2.j, and Section B.3.j.

Also, discussions of esthetic resources are located in Volume I, Chapter II, Section A.9, Section A.10, Section B.9, Section C.9, and Section D.9; Volume I, Chapter III, Section G; Volume I, Chapter VI, Section G; Volume I, Chapter V, Section G; Volume III, Chapter II, Section B.1.h, Section B.1.i, Section B.2.h, Section B.2.i, Section B.3.h, Section B.3.i, Section B.4.h, and Section B.4.i; Volume III, Chapter IV, Section F; and Volume III, Chapter VII.

1. Recreation - Esthetic Qualities of Project Areas

Some respondents felt that the Draft Statement understated the recreation and associated scenic-esthetic qualities of the proposed project area. Others stated that the impacts on such qualities were over-emphasized in that recreation and scenic areas outside the immediate tract areas would not be directly affected as a result of the proposed prototype program (2, 5, 25, 39, 43, 80, 217, 222, 237, 290).

Response

Recreation and associated scenic-esthetic qualities are described in the Final Statement by presenting information for each proposed prototype tract as well as for the oil shale and immediate surrounding region. An attempt was made to describe these qualities objectively and to avoid value judgments. The quality and type of outdoor

recreation experience and the associated scenic-esthetic values of an area are primarily controlled by location, landscape, soil, climate, relief, water, vegetation, and wildlife. All of the above components need to be considered when evaluating the impacts upon esthetics, recreation, and cultural values, including those of the areas surrounding development. Because of the interactions involved, the impacts were considered both at the regional level in Volume I, Chapter III, Sections A and F, and at the tract level in Volume III, Chapter IV, Sections A and G.

2. Unquantified Environmental Amenities and Values

The Draft Statement failed to quantify the worth of the land, its vegetative cover, and its wildlife, thus making it impossible to determine the environmental values to be "traded off" for oil shale development. For example, there should be some means of valuing fish and wildlife populations, the critical survival value of vegetation as food and shelter for wildlife, and wildlife losses when a natural canyon is converted to an artificially contoured landfill (38).

Response

The impacts on the environmental values mentioned above are detailed objectively in descriptive fashion. Where possible, numerical estimates are made in Volume I, Chapter III, and Volume III, Chapter IV, for example, number of grazing units lost, numbers of acres lost to wildlife habitat, and number of acres of vegetative cover lost. Many values, however, cannot be measured accurately in dollars. Attempts at such measurment are highly subjective and subject to different individual value judgments and do not contribute to objective analysis.

3. Open Space

Open space should be given a positive esthetic value and the impact on open space accounted for (25).

Response

There is no generally acceptable valuation method for assigning open space a quantitative economic value. The statement does, however, assign a positive value to "open space" areas be recognizing oil shale development and associated increases in population will cause the adverse effects of penetration of remote and primitive areas and reduction of open country recreation opportunities. (See Volume I, Chapter V, Section I, and Chapter VI, Section G).

4. Wild and Scenic Rivers

The statement could be expanded to describe more fully water resources in relation to surface and subsurface supplies and quantity. Presently, the Green River has wild and scenic river potential and the project impact on this potential has not been explored, particularly the water quality aspect (2).

Response

The relationship between the demand for water to support oil shale development and surface and ground water supplies and quantity is given in Volume I, Chapter IV, Section C, and Volume III, Chapter IV, Section C. Particular emphasis is given to the potential impacts on the White River which flows into Green River. Impoundments for surface water will tend to reduce a river potential for classification, as wild and

scenic, as noted in Volume I, Chapter III, Section C. Water quality impacts caused by development under the proposed prototype program are not expected to be of such a nature or magnitude to affect the potential of the Green River for classification as a wild and scenic river.

5. Effect of Development on Dinosaur National Monument and Canyonlands National Park

As industrialization of the oil shale areas proceeds, significant changes may occur in both the quality and quantity of the water resources in the Colorado River Basin. Will the pristine character of Dionsaur National Monument, Canyonlands National Park, and the parks along the lower Colorado gradually be lost due to increased use of the river water? (9).

Response

The location, nature and magnitude of future operations within the three-State area of Colorado, Utah, and Wyoming will be the controlling factor in the cumulative impact from oil shale development. If industrialization occurs, the character of the region will certainly change. However, the monuments and parks cited are remote from the location of the major oil shale resources and sites of expected development. It is not expected that oil shale development will have significant impact on those parks and monuments other than perhaps increased visitation as the region's population grows. Utilization of the Upper Basin States allocation of Colorado River water, either by an oil shale industry alone, or in combination with other uses, could reduce flow in the lower basin.

6. Undeveloped Wilderness Areas

Numerous comments were received relative to the impacts of an oil shale industry on undeveloped areas. Two areas were most frequently mentioned - the South Fork of the White River, and the proposed Flat Top Wilderness area (26, 39, 52, 80, 122, 145, 185, 196, 227, 241, 282).

Response

Increased population would probably develop increased recreation use in the environs surrounding the oil shale basins themselves. The areas mentioned above and others outside the oil shale basins are discussed in Volume I, Chapter II, Section A.10.

As discussed in Volume I, Chapter VI, Section G, the oil shale region is in open country utilized for outdoor recreation because of its remoteness, difficulty of access, and natural condtions. Oil shale development will result in local as well as basin and regional changes in recreation and esthetic resources. While development in the three-State region, together with the related new urban service and utility corridors, would utilize less than one percent of the recreation lands currently in existence, it would impact upon the existing recreation environment beyond the boundaries of the lease tracts themselves.

Recreation activities would shift to some extent from the more extensive types, e.g., hunting, hiking, etc., toward more intensive, urban-oriented recreation types, e.g., golf courses, reservoirs, play grounds, swimming pools, etc. Changes in the primitive nature

of the region due to industrialization would reduce its long-term productivity as a primitive outdoor recreation region. Opportunities for more flexible recreation patterns would be realized and would be suitable to a larger resident population. This rate of recreational development would be controlled by the individuals who currently live in the areas and those who will be brought in to support oil shale development. Nearby regional extensive recreational opportunities, such as the proposed Flat Top Wilderness area, would still be available to the regional population.

7. National Historical Sites in Rio Blanco County

Two potential national registered historical sites in the Rio Blanco County are listed by the Colorado Historical Society. These are the Thornburgh Battle Site and the Meeker Massacre Site. Several other sites have State significance (23).

Response

While the two sites mentioned are well known in that portion of Colorado, they are located outside of the Piceance Creek Basin proper. Thus, it is not expected that they would be adversely affected by development under the proposed prototype program. A number of other similar sites, such as the Rock School, are discussed in Volume III, Chapter IV, Section A.

H. Economic and Social Environment

Additional material concerning socioeconomic effects was added to the Final Environmental Statement. In addition to the specific comments and responses found below, additional data may be found in:

Vol. I	Chapt. III	Sec. A.11, Sec. B.11, Sec. C.10, Sec. D.10
Vol. I	Chapt. III	Sec. H.1.a, Sec. H.1.b, Sec. H.1.f, Sec. H.2.a, Sec. H.2.b, Sec. H.3.a, Sec. H.3.b, Sec. H.4.a, Sec. H.4.b
Vol. I	Chapt. V	Sec. H.
Vol. I	Chapt. VI	Sec. H
Vol. I	Chapt. VII	Sec. C
Vol. III	Chapt. II	Sec. B.1.h, Sec. B.2.k, Sec. B.3.k, Sec. B.4.k
Vol. III	Chapt. III	Sec. C
Vol. III	Chapt. IV	Sec. G

1. Changes in Socioeconomic Patterns (Lifestyles)

The statement in Volume I, VII-6D, that the change from a rural society to a more industrialized one would be beneficial, was questioned (41).

Response

The changeover to a more industrialized economic system from a system more heavily dependent upon ranching and/or agriculture is rarely an easy or smooth transition. However, the social problems facing urban centers today are known and attempts can be made to prevent them before they develop.

The growth that is expected in the oil shale region through 1981 will increase the existing population by 50 percent, but it will not transform it into a megalopolis. There can be a rational approach applied to this development, and it has already been started through the Council of Governments in Colorado which encompasses local community and county planning commissions. Because of the increased capital flow and broadening of the tax base, some of the existing social amenities would be upgraded, which is the basis for the conclusion regarding the beneficial effects to local communities. (For additional discussion of this subject, see Volume I, Chapter V, Section H). Additional information concerning urban development and its associated impacts is contained in Volume I, Chapters II and III, and Volume III, Chapters II and IV.

2. Urban Development

The statement did not adequately evaluate the impact of the proposed project on the urban environment nor does it provide sufficient information to evaluate it (2, 7, 14, 16, 23, 30, 39, 41, 43, 44, 49, 78, 85, 95, 122, 136, 137, 154, 155, 163, 181, 201, 212, 223, 233, 268, 280, 281, 290, 291).

Response

Many of the comments received recognized that the impact statement did point out and discuss the many urban problems associated with unplanned urban growth. These comments, however, were looking for answers to or solutions for individual community problems that could be associated with urban growth. Such specific solutions must be developed in the counties and cities affected. Planning is already under way in these localities and there is at least 3 years before construction of the first plant on public lands. Volume I, Chapter III, Section H contains a revised discussion of the impact of urban growth on the local communities and their existing support services and public facilities.

3. Inventory of Urban Facilities

The statement should include a basic inventory of the existing public facilities, and how the existing supply would affect the projected demand (2, 38, 41, 44, 163, 291).

Response

It is recognized that the influx of the new residents will significantly affect the environment. In measuring this impact, it was assumed that each existing school, hospital bed, etc., was fully utilized and that to accommodate the new population, new facilities would have to be built. In Volume I, Chapter III, Section H, the investment needed to build these facilities was calculated.

A comprehensive inventory and description of the existing facilities will be needed by local authorities as they plan for guidance of future growth. A number of detailed statistical series relating to such facilities are already maintained by local government and private organizations (See, for example, Volume I, Chapter II, Section A.11).

In Colorado, a Council of Governments in Colorado has been established, and, if a decision is made to develop oil shale within the region, it will play a major role in the planning and development of community needs and facilities. The Colorado Department of Natural Resources, in anticipation of oil shale development, is administering a series of Colorado Oil Shale Environmental Studies which began in 1972 and are jointly funded by the Federal, State and local governments, and industry. One of these studies, Land Use and Community Development, is expected to be completed in January 1974, before any operations could take place on private or public lands. One of the objectives of the study is an inventory and accumulation of data relating to physical, economic, and social facilities.

Although the States of Utah and Wyoming have not initiated similar studies, the information will be available to them.

4. Community Planning

The statement did not sufficiently discuss the planning requirements for a new community or the expansion of an existing community (2, 16, 291, 293).

Response

The development of a new town or community was presented in the Draft Statement as a possible alternative to continued growth within the existing communities. The Urban Growth and New Communities Development Act of 1970 administered by the Department of Housing and Urban Development provides a number of programs and funds to encourage the development of new communities.

There will be sufficient time for the planning of either a new town or expansion of the existing communities after a lease sale. If it decided to implement the proposed prototype program, no lease sale could take place until late 1973. The lessee would be required to submit a preliminary mining plan with his lease bid and a detailed development plan within 3 years. Under the most favorable circumstances, construction of the first plant on public lands could not begin until 1975, and initial operations could begin only in 1978.

The necessary regional planning has been initiated, as described in Item 3 above, and will be available in time to guide the needs of new and existing communities.

5. Land Speculation

The influx of people would cause land speculation and increased property taxes (20, 41, 233).

Response

There is little doubt that land for urban development will command a higher price than agricultural land. Proper zoning regulations and enforcement would be able to limit the amount of land subject to such development. This is a local problem which should be primarily controlled by the States and localities affected.

6. Reduction of Agricultural Land Use

Whereas agricultural land produces wealth, the use of such land for urban expansion is not wealth-producing. No cost benefit analysis is made of this change in land use (43, 163).

Response

The change in land use from agricultural to urban is discussed in Volume I, Chapter III, Section A. Urban development takes place via the operation of the marketplace. Land is transferred from agricultural to urban use when the price offered for it for development exceeds its value in agricultural use. For a general discussion of cost benefit analysis, see comment K.3, below.

7. Population Increases

Concern was expressed with respect to the impact of a sudden population increase on a presently stable, rural community. These comments ranged from the impact of new unemployment potentials to the very broad question of how this population increase will affect existing plans for the area (41, 122, 163, 231, 233).

Response

New expansion and growth normally creates a general sense of initial disorder. The potential social impacts have been considered in Volume I, Chapter III, Section H.

The prototype program is to be developed as any new industrial operation and will be privately run. The Federal Government will not interfere with private hiring practices, other than to see that

equal opportunity and labor legislation is enforced. However, there has been some indication by private industry that they will, in fact, hire locally where possible.

Whenever a new major employing industry begins operation, there is always a percentage of the applicants who are unqualified. However, the overall net impact should be an increase in total employment, which represents a net benefit not only to the local communities but also the Nation as a whole. Though there will probably be more people in the area turning to welfare or unemployment compensation, the increase should be less than proportional to the total increase in population. The county or city should not, therefore, be expending a greater percentage of their revenue on welfare.

Existing plans for development will need to be reassessed in light of the impact expected from oil shale development. This process has already been initiated as described in Item 3, above.

8. Population Pressures and Resulting Economic Imbalances

Concern was expressed about strikes and winter shutdowns during the construction phase and the impact on the existing population to whom the program will mean higher costs and no equivalent increase in income (41, 233).

Response

These are problems that pertain to the functioning of an economic system in any and all communities. They are not peculiar to oil shale development. The local communities and regions are

aware of what development means and with adequate preplanning can attempt to alleviate social and economic problems in a way that will benefit the community as a whole.

9. Taxes on Mobile Homes in Financing Urban Development

Since mobile homes are not taxable as real property in most jurisdictions, the local tax revenue of $1,000 per capita may be unrealistically high (16).

Response

In Colorado, mobile homes are taxed as real property; however, the rate is much lower than for private homes. It might be possible to increase the tax rate for mobile homes or institute some type of user fee on them. However, it was estimated that the oil shale facilities would contribute 75 percent of the revenues collected by the local governments, so the impact of tax loss from mobile homes will not be great.

10. Bond Issuance and Distribution of Taxes In Financing Urban Development.

The Draft Statement (Volume I, page III-80) acknowledges the problem created by generation of large tax revenues in the county where the plant is located and large expenditures in an adjoining county where the employees live but offers no recommendation for redistribution of these revenues. Small communities may have difficulty in financing growth via municipal bonds since permissible indebtedness is a function of the tax base (41, 51, 163, 231).

Response

The Final Statement (Volume I, Chapter III, Section H) considers additional suggestions to assist in redistribution of tax revenues and in the underwriting of bond issues, including the Department of Housing and Urban Development program for assistance in the financing of new community development.

11. Revenues from Hunting

The economic benefits of hunting to Rio Blanco County was not discussed (2).

Response

The Final Statement has been revised (Volume I, Chapter II) to state that hunters contribute more than $4 million per year to the county.

12. Mature Industry

The statement does not consider the socio-economic impact of a mature oil shale industry (44, 163, 231, 283).

Response

The economics of oil shale processing will undoubtedly affect the rate at which a mature industry develops. As the production of 1-million barrels per day will represent second generation technology, it is assumed that production rate would represent a mature industry. However, the schedule of development will be constrained by the logistics of construction, local, state, and

Federal regulations and the operational and environmental experiences and costs of the first commercial units. In addition, development of a mature industry would require the leasing of additional public lands, which would involve the preparation and publication and review of another environmental impact statement.

Although it cannot be predicted with certainty that this prototype program will develop into a mature industry, the possibility of a mature industry developing does exist. If this development occurs, it would cause cumulative socio-economic impacts throughout the region. The Final Statement (Volume I, Chapter III, Section H) discusses some of these broad regional impacts.

In general, the development of a mature industry of 1-million barrels per day would result in a total population increase of 115,000 people. At this point, it is not possible to assess how or where the additional urbanization will occur. However, it can be stated that a mature industry would likely produce some additional ancillary urban development, that other industries may develop, and that changes in land use patterns would occur (See Volume I, Chapter III, Section B). The results of prototype development will permit a realistic review of this larger development should the Department seek to lease more public lands. In that event, such impacts would be considered in an environmental statement on the additional leasing.

13. Impact of Industry Shutting Down

Concern was expressed about the "boom and bust" aspects of oil shale development. The question was specifically asked: "Are we to have another Appalachia?" (30, 32, 41, 95, 114, 163, 231, 233).

Response

It is possible to look to other areas, such as Appalachia, in planning a course of action to avoid or minimize the problems experienced in those areas.

One of the major problems of Appalachia was the past lack of concern for the physical environment. This will not be the case in the oil shale region, since environmental protection has been an objective of the proposed program from its inception and measures have been planned to ensure that the environmental impacts will be minimized as much as possible. The lessees will be obligated to utilize environmental controls that are much more comprehensive than any yet proposed for other mining and minerals development.

Economic dependency of an area on a single resource is the one aspect of the Appalachian example that is relevant to the development of an oil shale industry. If that base becomes incapable of supporting the population, many social problems result that do not have easy solutions. However, because it has happened in the past does not mean the problem must reoccur. Governments (local, state, and Federal) now realize, for example, that a community should not depend upon a single source for its economic base if at all possible and that a concerted cooperative effort should be made to bring in other industry.

As far as can be foreseen, the demand for liquid fuels will increase steadily over the long term. The oil shale region is not going to run out of resource or out of demand for its product for many times the initial 20-year term of a single lease. Once the

large investments is made in an oil shale retorting plant, operations will continue on that lease as long as operating costs can be recovered and the environmental standards obtained. Efforts to obtain a return on the invested capital will tend to mitigate the "boom and bust" aspects of development at a particular location.

14. Health Care

There is no organized health care system in the area of development and a shortage of doctors already exists. How can oil shale leasing be condoned in such a situation? (27, 292)

Response

The expanded size of the oil shale communities could attract and support more medical personnel than the smaller towns that now exist.

The taxes generated by the industry and the associated population will be sufficient to support the public facilities, including public health facilities, that they require. The financing of such facilities in advance of tax receipts and the distribution of tax receipts between counties is discussed in Volume I, Chapter III, Section H.

15. Accident Statistics

The logic of applying surface coal mine accident statistics to potential oil shale mining operations was questioned (31, 42, 137, 211).

Response

The Final Statement (Volume I, Chapter III, Section H.1.f) includes a range of accident frequency rates based upon both surface and underground mining operations in coal, metal, and nonmetallic

deposits. These data were used to estimate the frequency of accidents associated with oil shale development.

16. Health and Safety of Miners

Information was lacking about laws and regulations to protect the health and safety of the miners, adequate ventilation, emergency exits, noxious gases, dust and roof control plans (31, 42, 44, 78, 137, 211).

Response

Stringent Federal and State laws and regulations governing all aspects of health and safety in all mines are in effect and will apply to any oil shale mining operations. These laws include the Federal Metal and Nonmetallic Mine Safety Act of 1966 (30 U.S.C., §§ 721-740), the Occupational Health and Safety Act of 1970 (29, U.S.C., §§ 651-678), Public Law 91-452, October 15, 1970 (18 U.S.C., §§ 841-848) and the regulations promulgated thereunder (26 CFR 181), applicable State laws and all health and safety standards that are promulgated pursuant thereto. All oil shale mines will be inspected to ensure compliance with the approved mining plan, which will include plans for adequate ventilation, emergency exits, control of noxious gases and dust, and support plans for adequate roof control (See Volume I, Chapter III).

The lease includes stipulations that supplement the Department's regulations governing surface exploration, mining and reclamation of lands (43 CFR 23) and the operating regulations for mining (30 CFR 231). Lease and regulation provisions will require compliance with all applicable State and Federal regulations in effect at the time of the lease plus provisions that standards promulgated in the future will have to be met (Volume III, Chapter V).

17. Price of Imported Petroleum

Shale oil would tend to set an upper limit on the price of imported crude oil (11).

Response

Within the relevant timeframe, i.e., through 1985, shale oil production is projected as having the capability to reach a maximum of 1 million barrels per day. Even with this rate of production, considerable supplies of imported petroleum are expected to be required. If the price of imported petroleum rose to a level above that for shale oil, shale oil production could not be expanded in the short run to replace foreign imports and thus force the price downward. Over the long term, however, shale oil production could contribute to the establishment of an upper limit on crude oil prices.

18. Reliance on Foreign Oil Sources and Generation of Public Revenues.

The fact that reliance on foreign sources of oil does not generate public revenues at the Federal level was discussed by one respondent. These revenues under our present statutes are less than are derived from domestic production of an equivalent amount of energy (24).

Response

In addition to the comment offered, the writer included an economic analysis entitled, "Relative Tax Generation of Shale Plants versus Foreign Crude Oil Importation." The objective of the research paper was to estimate the magnitude of public revenues that are involved in one year's operation of a 100,000 barrel per day plant in Colorado.

The paper is included in reference 39, in Chapter IV of this Volume. In addition, the Department of the Interior has estimated taxes and revenues that will be generated from oil shale development. (See Volume I, Tables III-41, III-45, and III-49, and the associated text).

19. Land Use Planning and Control

The Final Statement should include regional land-use plans and controls designed to cope with social and economic impacts. (7, 36, 38, 39, 42, 44, 45, 52, 136, 222, 223).

Response

The social and economic impacts of the development of an oil shale industry have been assessed in Volume I, Chapter III, Section H. To the extent possible at this time, the anticipated effects of industrial development associated with urban growth have been projected. In the above-mentioned section, projections were made with respect to housing and classroom needs, power needs, and urban water needs. The Statement recognizes that many additional social impacts could occur (such as inadequate transportation routes and facilities). However, regional land use plans and controls cannot be formulated in this Statement since these are matters primarily within the jurisdiction of established planning commissions, and State and local governmental authorities.

20. External Costs

A criticism was raised that the Department computed the gross national and regional economic benefits of oil shale development, but failed to extend its economic assessments to anticipated external costs (supplemental material C-25).

Response

The focus of the present analysis is the description and assessment of environmental impacts, not an analysis of economic benefits. In effect, the environmental statement is addressed to the question of possible environmental "costs" associated with oil shale development. For the scale of development considered in Volume I, i.e., 1-million barrels per day, the impacts can probably be traced throughout the entire economy. This has not been attempted, but certain impacts do lend themselves to economic quantification and have been discussed in that fashion, e.g., number of jobs, income, tax flows, economic detriment to current water users due to the consumptive use of surface waters for oil shale use, and forage foregone by development. Where possible, the type and severity of other externalities, e.g., loss of wildlife, air quality impacts, and reduction in ecosystem productivity, are noted throughout the impact analysis of Volumes I and III, Chapters III and IV, respectively. While it is not possible to assess all environmental impacts in economic terms, every effort has been made to identify and quantitatively discuss all such "costs."

21. Social Services

Demands on social services such as schools, police, fire protection, waste disposal systems, water and housing are not explored (2).

Response

The possible impacts on the existing social environment have been generally discussed in Chapter III, Volume I, Section H. In that section, anticipated demands and costs for social services were projected based on available information.

At the present time, contract studies (referenced in G.3 above) are underway to analyze the socio-economic impacts in considerable depth. These studies are jointly funded by the Department of the Interior, State and local governments and industry. When completed, the studies will make available more detailed projections on the demands on schools, police protection, fire protection, waste disposal systems, water and housing, as a result of various levels of development.

I. Oil Shale Development: Alternatives

A large number of comments were received asking for further exploration of energy source alternatives to shale oil. The material discussing energy alternatives is the subject of Volume II of this Final Environmental Statement. In addition, alternatives to the proposed program and alternative tracts are considered in Volume III, Chapter IX.

1. Economic Compatability of Synthetic Fuels

Objection was made to the statement (Draft Statement, Volume II, page 50) to the effect that potential supplemental sources of oil (coal, tar sands, and oil shale) are estimated as "nearly competitive economically with crude oil" using currently known but as yet commercially unproven processes (73).

Response

The original statement in reference to oil shale is considered valid since current estimates on the required selling price of upgraded shale oil to yield 12 to 15 percent DCF return range from about $3.75 to over $4.00. Upgraded shale oil is a partially refined oil having a gravity of about 46° API and containing very little sulfur and nitrogen. Oil of this high quality has a current value of approximately $3.75 to $4.00 per barrel,[1/] indicating that

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1/ Winston, Morton M. Growth, Energy, and Oil Shale. Presentation (and preprints) at The Oil Daily Forum, New York, May 4 1972, 67 pp.; Roberts Meridity, Synthetic Fuels. Petroleum Today, American Petroleum Institute, V. 13, No. 2, 1972, pp. 16-19.

shale oil is "nearly competitive economically with crude oil." (For additional discussion, see Volume II, Chapter III, Section 1).

2. Recovery Estimate

The recovery figure of 100 billion barrels of oil from existing oil fields was questioned (73).

Response

The subject of the discussion relating to Figure III-4, Volume II, Chapter III, Section B, was not the amount of oil that could be recovered, per se, but was directed toward the interrelationship between price, technology, and crude oil supply. The 100-billion-barrel oil recovery estimate was compiled in 1965, which is the most recent review of this type. Although the data are somewhat dated, and may overestimate potential future supplies, the concept that supply depends on both price and technology is valid.

3. Reduced Energy Demand

The potential for energy savings should be reassessed, particularly in light of a recent report by the Office of Emergency Preparedness, "The Potential for Energy Conservation," October 1972 (33, 36, 39, 155, 202, 219, 232, 269).

Response

The Department has reviewed the subject report and the logistics, costs, and complexities involved in reducing energy demand. As a part of this analysis, those actions that increase fuel demand have also been reviewed. In general, translating potential savings into practical application is costly and requires extended periods to be effective. An expanded discussion of this subject is contained in Volume II, Chapter V, Section A.

4. Imported Petroleum

One comment (11) questioned the following statement in Volume II, at page 206:

> For some time to come the basic alternative to the production of 1 million bbls/day of shale oil will be 1 million bbls/day of imported petroleum.

Response

The forecasts of petroleum demand and of domestic supply indicate a gap of over 13 million barrels per day by 1985. Part of this gap may be filled by shale oil, coal liquefaction or tar sands. It is extremely unlikely that any of these alternatives, even in combination, can fill the entire gap by 1985 and the difference will be made up by imports. As a practical matter, the statement is correct.

5. Canadian Imports

One comment suggested that Canadian oil imports would offer a secure supply of petroleum and, when combined with storage, could permit increased imports without risk to national security (39).

Response

The future availability of Canadian energy supplies to U.S. markets will depend on Canada's own domestic demand-supply position. Canadian policy on gas, for example, has been to export only that gas determined to be surplus to its own requirements as projected over a 25-year period. In November, 1971, the Canadian National Energy Board dismissed applications to export gas to the United States based on its conclusion that at that time there was no exportable surplus.

Canada may represent an important exception among foreign oil sources. The United States provides a natural market for this crude and differences in costs, while favoring Canadian producers. are not so great that they cannot be reconciled. One important impediment to free oil trade with Canada is their total dependence on imported oil supply to their Eastern Provinces. Any interruption to these imports would directly or indirectly increase U.S. vulnerability.

As with natural gas, the present producing provinces do not appear to have sufficient potential to permit large petroleum exports to the United States. The significant potential appears to be Arctic oil and gas, as discussed in detail in Volume II, Chapter V. Realization of this potential, however, may depend in part on the ability of Canadians to reconcile their desire for control of industrial development with their growing needs for foreign capital. Another factor is international attitudes toward a trans-Canadian pipeline. Several factors make a bilateral arrangement for such an oil pipeline difficult, including the U.S. requirement for the entire capacity of an oil pipeline, uncertainty and delay in arranging for financing of a trans-Canada oil pipeline, and delay of the project, pending the completion of environmental, engineering, and construction studies for a Canadian route. Pending resolution of these issues, it is not possible to speculate further on Canadian imports other than to point out the potential, as has been done in Volume II, Chapter V.

6. Reuse of Waste Lubricating Oils

Waste lubricating oils should be considered as an alternative to oil shale development (7).

Response

The part of crude oil that goes into lubricating oil each year amounts to about 65 million barrels. About 25 million are used as industrial lubricants and 25 million barrels are used in the Nation's automobiles. Some 15 million barrels are exported. Most of the industrial oil is either spent or reclaimed, leaving little excess. Of the 25 million barrels used for automobiles, an estimated 8 million barrels each year are dumped onto the land surface, much of which runs off into streams. There is no way to know what this figure might be in 1985 or beyond, but even if it doubled, it would represent only 45 thousand barrels per day. Thus, reuse of lubricating oils is not an alternative to oil shale development.

7. Outer Continental Shelf Development (OCS)

The Draft Statement did not adequately reflect the potential environmental effects of oil and gas development on the OCS (42, 62, 66).

Response

Outer Continental shelf development has been the subject of several recent environmental impact analyses. These were consulted in preparing Volume II, Chapter V, Section C.1, and the most recent is referenced therein.

8. Nuclear Stimulation

Nuclear stimulation is one method proposed to increase the flow of natural gas from an area that is geographically located directly below oil shale deposits. The mutual compatability of simultaneous development of nuclear stimulation and oil shale was questioned (19, 67, 206, 208, 209, 212, 214, 293).

Response

The Department has reviewed the technical aspects of this issue and has concluded that full field nuclear stimulation of gas-bearing sands may be incompatible with concurrent underground development of oil shale. Both might be conducted in a common area subject to constraints and additional responsibilities. An analysis of this subject is contained in Volume II, Chapter V, Section C.3.

9. Deep-Mined Coal

It was suggested that deep-mined, low-sulfur coal, in both the East and West, be considered as an alternative to oil from oil shale (36).

Response

Deep-mined coal development has been deterred by a number of interrelated economic and environmental factors. Over the time frame under consideration, through 1985, it is not believed that deep-mine productive capacity can be significantly increased over that now forecast for this source. For this reason, deep-mine coal is not considered to be a viable alternative to oil shale development. Coal as an alternative is discussed in Volume II, Chapter V.

10. Energy Resource Development on Public Lands

Information was requested on the relationship between prototype oil shale development and other energy resource development on pulbic lands. The programs of specific interest were Southwest Energy, North Central Power, Northern Great Plains Resource Program, and Geothermal Energy (7, 36, 39).

Response

The subject studies are mostly regional in nature and relate to separate and distinct geographic areas. Thus, aggregative effects from simultaneous development would be negligible except for Southwest Energy development, which uses water from the Colorado River system.

Southwest Energy Study - This study was undertaken to examine the effects of four levels of coal-fired electric generation using Colorado River Basin coal.[1/] Within this area, a generating capacity of 20,350 MW is anticipated by 1990.

The study examined the existing and potential economic, social and environmental impacts of the coal-fired electrical generating plants. The environmental effects of the existing plants were identified and quantified where data were available. Problematical environmental impacts, those whose effects were unknown or have not been tested, were identified for monitoring and research. The future effects of the plants under construction were predicted based on the information gained from study of plants being completed according to design.

1/ Department of the Interior. Southwest Energy Study; An Evaluation of Coal-Fired Electrical Power Generation in the Southwest, November 1972.

Due to inadequate abatement measures and controls, the operating coal-fired plants in the study area contribute objectionable environmental impacts. The Four Corners power plant (located near Farmington, N.M.), since initial operation in 1963, has discharged substantial quantities of both solid and gaseous pollutants to the atmosphere. Coal utilized by the plant is high in ash content and contains sulfur and numerous trace elements. The high ash content, together with the initial failure to install more efficient removel equipment, contributed to reducing visibility and high, unacceptable particulate levels.

Efforts to reduce emissions through the installation of electrostatic precipitators, wet scrubbers, and other devices are expected to bring the Four Corners plant into compliance with existing State and Federal air quality standards by December 1973. Diffusion model analysis of calculated stack emissions for all plants involved indicates that except for brief periods under unusual atmospheric conditions, the plants would meet Federal air quality standards. Furthermore, no significant additive effect of emissions caused by one plant or those of another is anticipated if the plants are separated by 60 miles or more. Local plant and regional atmospheric monitoring programs are now required in the Colorado River Basin to provide a base line of air quality and visibility data to determine existing environmental effects and provide guidance for future plant construction and operation.

The effects of power plant operation and coal mining on ground or surface water have not yet been determined. Makeup and cooling water is recycled at all plants and Four Corners is the only unit where waste water from plant operations is returned to the water source. Approximately 15,000 acre-feet of water is consumed each year for each 1,000 MW of power generated.

The consumptive use of Colorado River system water is the common element between Southwest Energy and oil shale development. The water requirements for use in Southwest Energy development have been considered in arriving at the water available for oil shale development (Volume I, Chapter II, Section A.5). The cumulative impact of these and other projects in terms of an increase in salinity at Hoover Dam, in the absence of mitigating measures, has been calculated, as have the economic penalties associated with such salinity increases.

North Central Power Study[1/] - was a joint study program, unrelated to the proposed prototype program, involving private utility companies and governmental agencies to promote the coordinated development of electrical power supply in the North Central United States.[2/] The basic purpose was to investigate the

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1/ North Central Power Study, Report of Phase I. Prepared Under the Direction of Coordinated Committee North Central Power Study, October 1971.

2/ The Study area was limited to the Coordinating Committee local area and includes all or major parts of the States of Utah, Colorado, Wyoming, Idaho, Montana, North Dakota, Missouri, South Dakota, Nebraska, Kansas, Iowa, Minnesota, and minor parts of Illinois, Oregon, and Wisconsin.

feasibility of constructing large mine-mouth thermal plants located in the substantial coal fields east of the Rocky Mountains. The electrical power developed would be delivered to major load centers by extra-high-voltage transmission lines.

The first phase of the study has been completed, but there are no definite plans, at this time, to continue this specific study. Coal was the only natural resource considered in the initial phase. Environmental and social impacts were not included in the scope of the study, but procedures for meeting Federal and State environmental requirements were considered.

Northern Great Plains Resource Program (NGPRP) - is also concerned with the Nation's coal resources of Montana, Wyoming, South Dakota, North Dakota, and Nebraska. This area is estimated to contain 874 billion tons of coal, approximately 35 billion tons of which is recoverable with existing technology.

The NGPRP is an outgrowth of public concern in the region and of prior studies of the region's resources undertaken by the Federal and State governments as well as private organizations. Because these prior studies were limited in scope, such as the North Central Power Study, NGPRP will examine not only the coal resource and environmental factors, but other minerals such as uranium and bentonite, the oil and gas reserves, and such values as forage, forests, wildlife, water, recreation, and socioeconomic factors resulting from population changes.

The entire region to be evaluated is within the Missouri River Basin drainage. Some consideration has been given to using part of Wyoming's share of Upper Colorado River Basin water for coal gasification and power generation in the Missouri River Basin of Wyoming by trans-basin diversion. If this should take place, it would use water that is now considered potentially available for oil shale d development in Wyoming. Except for this, there would be little opportunity for cumulative impacts on water with oil shale development which would occur in the Colorado River Basin drainage. The geography (e.g., Continental Divide) and the distances involved would largely preclude cumulative effect from other environmental factors. For additional discussions, see Volume II, Chapter V, Section B.5.

Geothermal Energy - Presently, commercial development of geothermal resources is limited to the Geysers, California. As of July 1973, the generating capacity is 298 MW and this is expected to increase to about 600 MW by 1975. The National Petroleum Council projects 7,000 MW from geothermal energy by 1985 with existing technology.

Within the Colorado River Basin, the Imperial Valley of Southern California appears to offer potential for geothermal energy development. It also offers potential for water production and is under investigation by the Bureau of Reclamation and the Office of Saline Water (Volume I, Chapter II, Section A.5.a.) Treated geothermal waste water of acceptable quality may be discharged into the lower reaches of the Colorado River system to assist in achieving salinity control. Except for this, no other direct cumulative effects are anticipated from oil shale and geothermal energy development. Additional information on geothermal energy may be found in Volume II, Chapter V. Section B.8.

11. National Energy Policy: Research and Development

A number of respondents have suggested that a National Energy Policy be established and the full role of all alternative energy technologies be assessed prior to oil shale development on public lands (2, 7, 72, 18, 22, 30, 36, 38, 41, 44, 45, 72, 73, 83, 89, 99, 117, 121, 129, 146, 153, 155, 173, 184, 188, 193, 202, 204, 214, 219, 222, 228, 229, 230, 233, 241, 245, 247, 269, 273).

Response

The coincidence of a number of factors has underlined the need to formulate a current and precise energy policy: the Nation has begun to reach the economic limits of some of its energy resources; energy technology offers future prospects but is short on current performance; a new environmental consciousness has curtailed the use of some important energy supplies; and drastic shifts in foreign oil policies have raised new questions concerning the assured availability of foreign supplies.

This is a transitional period in the development of energy policy, and the Government is seeking a central course among available options that will best serve the needs of the Nationa. The goal is to furnish the administrative and economic climate under which industry can provide fuel supplies in adequate amounts at reasonable costs, with minimum environmental degradation. To achieve these ends, President Nixon, in his Clean Energy Message to Congress

of June 14, 1972, detailed a program to insure an adequate supply of clean energy:

> ...to sustain healthy economic growth and improve the quality of our national life...

That program contained the following elements:

(1) Facilitate research and development for clean energy;

(2) Make available the energy resources on Federal lands;

(3) Assure a timely supply of nuclear fuels;

(4) Use energy more wisely;

(5) Balance environmental and energy needs; and

(6) Organize Federal efforts more wisely.

With regard to oil shale, President Nixon stated that:

> I believe the time has come to begin the orderly formulation of a shale oil policy - not by any head-long rush toward development but rather by a well considered program in which both environmental protection and the recovery of a fair return to the Government are cardinal principles under which any leasing takes place. I am therefore requesting the Secretary of the Interior to expedite the development of an oil shale leasing program including the preparation of an environmental impact statement. If after reviewing this statement and comments he finds that environmental concerns can be satisfied, he shall then proceed with the detailed planning. This work would also involve the States of Wyoming, Colorado, and Utah, and the first test lease would be scheduled for next year.

This prototype program is therefore an integral part of the President's comprehensive Clean Energy Program.

On April 18, 1973, President Nixon delivered his second energy message to the Congress of the United States. In that message, the President set forth the principles of a National Energy Policy. That portion of his second energy message is reproduced below:

NATIONAL ENERGY POLICY

In 1971, I sent to the Congress the first message on energy policies ever submitted by an American President. In that message I proposed a number of specific steps to meet our projected needs by increasing our supply of clean energy in America.

Those steps included expanded research and development to obtain more clean energy, increased availability of energy resources located on Federal lands, increased efforts in the development of nuclear power, and a new Federal organization to plan and manage our energy programs.

In the twenty-two months since I submitted that message, America's energy research and development efforts have been expanded by 50 percent.

In order to increase domestic production of conventional fuels, sales of oil and gas leases on the Outer Continental Shelf have been increased. Federal and State standards to protect the marine environment in which these leases are located are being tightened. We have developed a more rigorous surveillance capability and an improved ability to prevent and clean up oil spills.

We are planning to proceed with the development of oil shale and geothermal energy sources on Federal lands, so long as an evaluation now under way shows that our environment can be adequately protected.

We have also taken new steps to expand our uranium enrichment capacity for the production of fuels for nuclear power plants, to standardize nuclear power plant designs, and to ensure the continuation of an already enviable safety record.

We have issued new standards and guidelines, and have taken other actions to increase and encourage better conservation of energy.

In short, we have made a strong beginning in our effort to ensure that America will always have the power needed to fuel its prosperity. But what we have accomplished is only a beginning.

> Now we must build on our increased knowledge, and on the accomplishments of the past twenty-two months, to develop a more comprehensive, integrated national energy policy. To carry out this policy we must:
>
> -- increase domestic production of all forms of energy;
>
> -- act to conserve energy more effectively;
>
> -- strive to meet our energy needs at the lowest cost consistent with the protection of both our national security and our natural environment;
>
> -- reduce excessive regulatory and administrative impediments which have delayed or prevented construction of energy-producing facilities;
>
> -- act in concert with other nations to conduct research in the energy field and to find ways to prevent serious shortages; and
>
> -- apply our vast scientific and technological capacities -- both public and private -- so we can utilize our current energy resources more wisely and develop new sources and new forms of energy.
>
> The actions I am announcing today and the proposals I am submitting to the Congress are designed to achieve these objectives. They reflect the fact that we are in a period of transition, in which we must work to avoid or at least minimize short-term supply shortages, while we act to expand and develop our domestic supplies in order to meet long-term energy needs.

In an Executive Order that accompanied his second energy message, the President ordered the establishment of a special committee on energy, and a National Energy Office. This committee and office are to continue to develop a more comprehensive, integrated national energy policy.

The President discussed shale oil development again in his second energy message. He said:

> At the time of my Energy Message of 1971, I requested the Secretary of the Interior to develop an oil shale leasing program on a pilot basis and to provide me with a thorough evaluation of the environmental impact of such a program. The Secretary has prepared this pilot project and expects to have a final environmental impact statement soon. If the environmental risks are acceptable, we will proceed with the program.
>
> To date there has been no commercial production of shale oil in the United States. Our pilot program will provide us with valuable experience in using various operational techniques and acting under various environmental conditions. Under the proposed program, the costs both of development and environmental protection would be borne by the private lessee.

Another important element in the President's program is the role of research. The Office of Science and Technology has been directing an extensive assessment of new energy technologies in order to identify and implement the most promising set of research programs in the energy field. Included in this assessment are:

(1) Clean fuels from coal

(2) Advanced central station fossil fueled electric power

(3) Extraction of energy fuels

(4) Nuclear fusion

(5) Nuclear breeder strategy

(6) Synthetic fuel systems

(7) Total energy for urban systems

(8) Electrical systems

(9) Solar systems

(10) Transportation energy systems

(11) Geothermal energy

At the present time, the Federal Government spends significant sums on research and development aimed at improving the methods for locating, producing, converting, and transporting both the primary energy sources, petroleum, gas, coal, uranium and water power, and the secondary energy source, electricity. Research is also under way to develop new advanced sources such as oil shale, fusion energy, geothermal steam, and solar energy. The government also supports research on energy in high-demand fields such as transportation, housing, etc.

During the past several years, there has been major new emphasis on and significant funding increases for energy research and development (R&D). This emphasis reflects rising concern over how the nation is to meet its growing demands for energy without degrading the environment.

Federal energy R&D funding for the past five years has been assessed by staff members of the Office of Science and Technology and their results are presented by major categories in Tables IV-1 and IV-2. In summary, however, energy R&D funding increased over 72 percent or $261 million, from Fiscal Year 1969 to Fiscal Year 1973. This represents a compounded growth rate of more than 11 percent. The increase is due in part to expansion of several key efforts including the fast breeder nuclear reactor, coal gasification, sulfur oxide removal from fossil fuel stack gases, and controlled thermonuclear fusion.

TABLE III-1.--Federal Energy Research and Development Funding[1/]

Fiscal Year 1969 through Fiscal Year 1973
(Millions of dollars, unless otherwise indicated)

	1969	1970	1971	1972	1973	1-year increase (percent)	5-year increase (percent)
Coal resources development.....	$ 23.3M	$ 30.4M	$ 49.0M	$76.8M	$ 94.4M	22.9	305
Petroleum and natural gas.....	13.5	14.8	17.5	23.8	26.1	9.7	93.3
Nuclear fission							
LMFBR[2/].....	132.5	144.3	167.9	237.4	261.5	10.2	97.4
Other civilian nuclear power[2/].....	144.6	109.1	97.7	90.7	94.8	4.5	-34.4
Nuclear fission							
Magnetic confinement[2/]..	29.7	34.3	32.3	33.2	40.3	21.3	35.6
Laser-pellet[2/3/].....	2.1	3.2	9.3	14.0	25.1	79.2	1095.2
Energy conversion with less environmental impact.....	12.3	22.9	22.8	33.4	55.3	66	350
General energy research and development.....	3.0	4.2	8.7	15.4	24.1	66.2	753.3
Total and average.....	361.0	363.2	405.2	524.7	621.6	18.4	72.2

TABLE III-2.-Federal Energy Research and Development[1/]

Fiscal Year 1969 through Fiscal Year 1973
(Millions of dollars)

	Agency[6/]	1969	1970	1971	1972	1973
Coal resources development:						
Production and utilization gasification, liquifaction, and MHD	DOI-BOM	$ 12.3	$ 13.2	$15.4	$ 14.7	$19.0
	DOI-OCR	8.7	13.5	18.8	31.1	45.3
Mining health and safety research	DOI-BOM	2.3	3.7	14.8	31.0	30.1
Petroleum and natural gas:						
Petroleum extraction technology	DOI-BOM	2.6	2.7	2.7	3.2	3.1
Nuclear gas stimulation[2/]	AEC	2.4	3.7	6.1	7.0	7.5
Oil shale	DOI-BOM	2.5	2.4	2.7	2.6	2.5
Continental shelf mapping	DOI-GS	-	-	-	5.0	7.0
	DOC	6.0	6.0	6.0	6.0	6.0
Nuclear Fission:						
LMFBR[2/]	AEC	132.5	144.3	167.9	236.6	259.9
	TVA	-	-	-	0.8	1.6
Other civilian nuclear power[2/]	AEC	144.6	109.1	97.7	90.7	94.8
Nuclear fusion:						
Magnetic confinement[2/]	AEC	29.7	34.3	32.3	33.2	40.3
Laser-pellet[2/3/]	AEC	2.1	3.2	9.3	14.0	25.1
Energy conversion with less environmental impact:						
Cleaner fuels R&D stationary sources	EPA	10.7	19.8	17.4	24.5	29.5
SO_x removal	TVA	-	-	-	2.6	15.2
Improved energy systems	HUD	0.3	0.8	3.0	2.4	2.8
Thermal effects R&D	EPA	0.5	0.8	0.6	0.7	1.0[4/]
	AEC	0.8	1.5	1.8	3.2	6.8[4/]
General energy research and development:						
Energy resources research[5/]	NSF	-	1.1	5.0	9.8	13.4
Geothermal resources	DOI	0.1	0.2	0.2	0.7	2.5
Engineering energetics research	NSF	2.9	2.9	2.7	4.0	4.7
Underground transmission	DOI	-	-	0.8	0.9	1.0
Cryogenic generation	NBS	-	-	-	-	1.0
Non-nuclear energy	AEC	-	-	-	-	1.5
Total		$361.0	$363.2	$405.2	$524.7	$621.6

Footnotes - Tables IV-1 and IV-2

1/ The funding listed in these tables covers the Federal research and development programs in development-exploration and production, conversion, and transmission of our energy resources. This funding includes energy conversion for stationary applications only; funding for improved mobile applications (e.g., automotive, rail, seagoing) are not included. Fundamental research on environmental health effects of combustion products and low-dose radiation exposure is not included.

2/ This funding includes operating equipment and construction costs.

3/ The primary applications of the multipurpose laser-pellet effort are for other than energy production (see text).

4/ This entry includes $1.5 million for dry cooling tower research and development under the AEC's new Non-Nuclear Energy research and development category. Other related work is carried out under Other Civilian Nuclear Power.

5/ The NSF RANN Program includes research on solar energy as well as fundamental energy policy studies.

6/ DOI - Department of the Interior
BOM - Bureau of Mines
OCR - Office of Coal Research
AEC - Atomic Energy Commission
GS - Geological Survey
DOC - Department of Commerce
TVA - Tennessee Valley Authority
EPA - Environmental Protection Agency
HUD - Housing and Urban Development
NSF - National Science Foundation
NBS - National Bureau of Standards

NOTE: The totals in Tables IV-1 and IV-2 differ from the earlier total reported at the time the Fiscal Year 1973 budget was released (p.56, The Budget of the United States Government for Fiscal Year 1973). The data presented in tables IV-1 and IV-2 includes additional budget components, viz., Coal Mine Health and Safety Research is included in the Bureau of Mines budget and capital and equipment as well as operations are included in the Atomic Energy Commission Budget.

SOURCE: Executive Office of the President,
Office of Science and Technology, May 25, 1972.

Although the funding increase is probably the survey's most striking feature, another is an obvious trend toward a Federal program that balances the energy resources of the nation and the engineering effort required to utilize those resources most effectively. For example, coal research funding has been growing at a much faster rate than nuclear power funding, 305 percent compared to 29 percent over the 5-year period. Significant increases in funding for stack gas cleanup technology and coal gasification are aimed at making the Nation's abundant coal resources available for both electric generation and industry. Where nuclear fission accounted for 77 percent of the Fiscal Year 1969 energy research budget, the liquid metal fast breeder reactor effort (LMFBR) has grown by 97 percent thus, reflecting its emerging status as a national priority program. Controlled thermonuclear fusion, geothermal steam, and solar energy have also received considerably more attention as funding patterns evolved.

Development of new sources are investments in the future and not a means of remedying today's energy needs. Technological development of solar energy, fuel cells, magnetohydrodynamics, and others will require long lead times for development of usable technology and, if successful, extended periods of modification before general acceptance is attained. Only modest amounts of funds will be used to administer the prototype leasing program (less than $1 million per year). Oil shale should be viewed as only part of the total energy picture, its development being

expected to proceed concurrently with the development of other energy sources. At the same time, Government funded research does include exotic and presently uneconomical sources of energy, consistent with a longstanding Government policy of performing advance research in areas that private industry cannot conduct because of limited resources and the need to obtain short-term profits on research investments. Commitments of capital by private enterprise to utilize one resource to the exclusion of another is a decision that must be based upon many variables, including technological capabilities, environmental impacts, and economics. Government policy can create incentives or impediments to specific development, but ultimately, the development of any of the energy resources must provide a competitive return on that investment.

12. Delay Program - Require More Studies and Planning

A number of comments suggested that the proposed prototype leasing program be delayed until the joint Federal, State, and local industry studies being conducted in Colorado are completed (26, 29, 39, 42, 57, 77, 82, 202, 205, 215, 220, 224). In addition, requests were made for more studies and planning (5, 23, 33, 36, 38, 40, 45, 51, 72, 86, 93, 97, 127, 130, 134, 139, 142, 144, 146, 150, 151, 154, 166, 174, 175, 181, 183, 188, 189, 191, 269).

Response

This subject is discussed in Volume III, Chapter IX, Section D. As an alternative to the program, as proposed, the Government could delay implementing the program indefinitely. The purpose of this delay would be to obtain further information concerning ways to mitigate the environmental impacts of oil shale development and/or to search for new locations that may have fewer environmental impacts.

Of particular relevance is the possibility of delaying the program until the joint government/industry environmental studies now being conducted in Colorado, are completed. Jointly funded by the local, State, Federal governments, and industrial organizationa administered by the Colorado Department of Natural Resources the Colorado Oil Shale Environmental Planning (COSEP) began in 1972 and is focused on four basic areas:

Study	Cost	Completion Date
Environmental Inventory and Impact (direct impacts of industrial development)	$160,000	7/31/74
Water Resources Management (Surface and subsurface water resource and impact study)	280,000	6/30/74
Revegetation and Surface Rehabilitation (Spent shale disposal and revegetation techniques)	130,000	12/31/74
Regional Development and Land Use planning (inventory existing communities and land use and developed alternate growth patterns)	145,000	1/1/74

The relationship between the past environment-related activities, the ongoing COSEP studies, and expected development is shown in Figure III-1.

Each of the four Colorado studies is scheduled for completion before 1975. Oil shale development on public lands under the proposed program could not begin before detailed development plans have been prepared and publicly reviewed. These would not be available until about 1976. Thus, the results of the Colorado

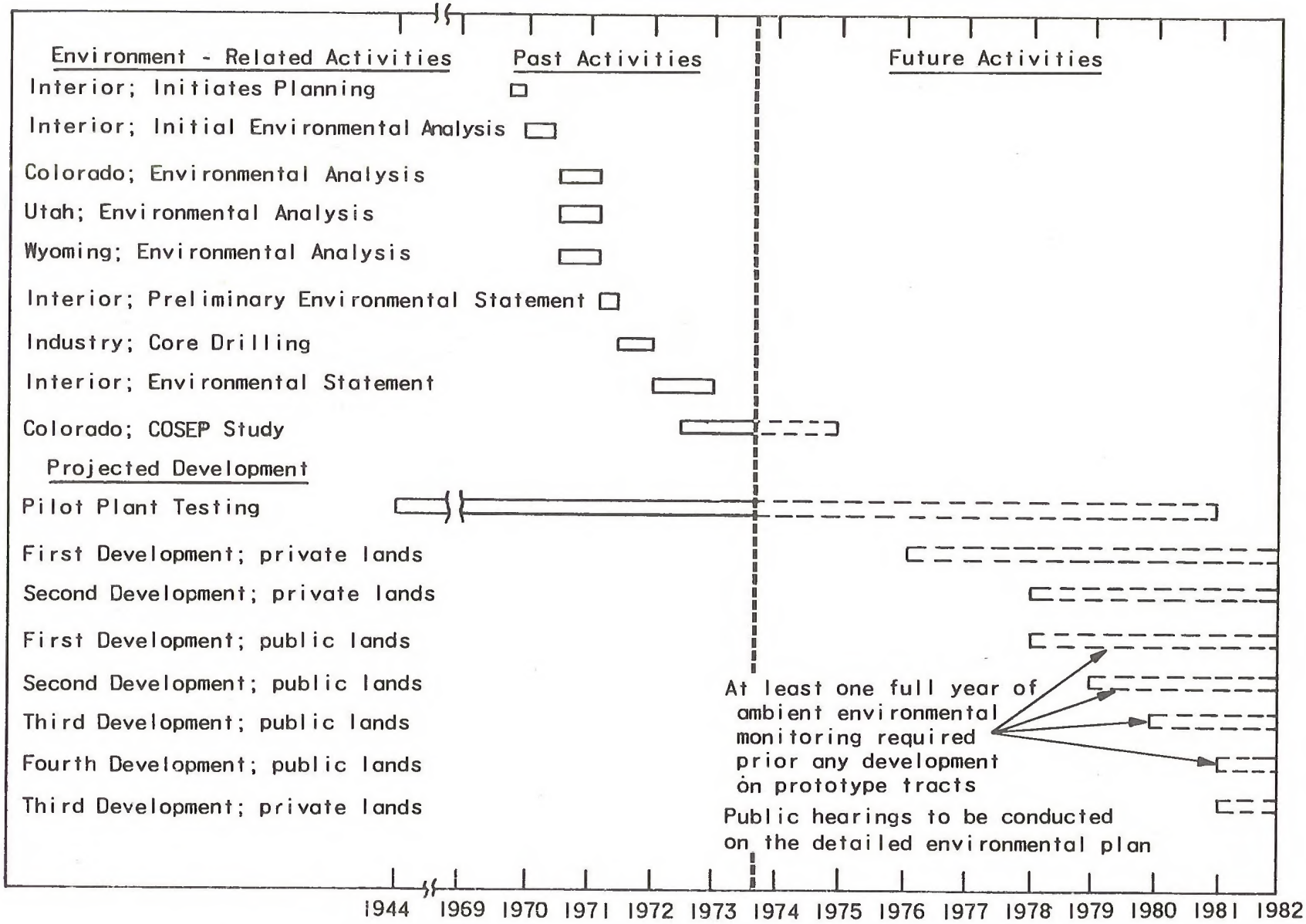

Figure III-1--Environmental Analyses Compared With Projected Development.

studies would be available for each lessee to incorporate into his detailed plans for development prior to physical development of the resource itself.

13. Energy Crises, Hasty Action, Justify Program

Numerous comments characterized the oil shale leasing program as a hasty action by the Department of the Interior to accelerate the development of this resource because of the energy crises. Others indicated that, for various reasons, Interior has failed to justify the leasing program (57, 145, 204, 215, 268, 291). On the other hand, numerous comments cited the energy crisis and the need for oil shale development (7a, 11, 21, 53, 54, 55, 57, 64, 68, 69, 70, 71, 72, 73, 75, 200, 203, 210, 213, 235, 253, 254, 256, 261, 262, 271, 272, 273, 278, 279, 284, 290).

Response

The purpose of the environmental statement is not to justify a particular proposed action but to objectively describe and assess the known facts about environmental impact for consideration by decision-makers and the public in general. The future demand for petroleum is particularly difficult to anticipate with any degree of assurance. Additional discussion of the energy situation in general, petroleum demand and supply, and the potential role of oil shale is discussed in Volume II, Chapters II, III, and IV. As discussed therein, oil from oil shale cannot be expected to contribute significant quantities of energy in this decade, however, it can contribute significant quantities after 1980. The prototype leasing program is designed to expand the range of energy options available for an energy consuming society.

As documented in Volume I, Chapter I, the prototype program has evolved over a 3-year period. Indeed, the present program is but one in a series of events that began in 1920 when oil shale was designated as a "leasable mineral" under the Mineral Leasing Act. The following chronology will help place the current effort in perspective:

1920--Leasing act made oil shale a leasable mineral with possibility for Federal government to receive rent, royalties, and other income from shale development.

1930--Oil shale withdrawn from leasing "for the purpose of investigation, examination and classification."

1943--U.S. Bureau of Mines began oil shale research and development under the Synthetic Liquid Fuels Act.

1956--Bureau of Mines discontinued research work at Rifle, but research at Laramie, Wyoming, continues today.

March 1963--Shell Oil Company applied to Interior for an oil shale lease. Four other applications were filled immediately thereafter. Interior was asked by industry to rescind the 1930 withdrawal order.

June 1963--A study, Status and Problems of Colorado Oil Shale Development, was completed for the State of Colorado.

November 1963--Interior Secretary Udall requested public participation in suggesting procedures for developing oil shale.

December 1963--Colorado Governor Love appointed an Oil Shale Advisory Committee which remains active today.

June 1964--Interior Secretary Udall received over 200 responses to his request for oil shale development suggestions.

June 1964--Secretary Udall appointed a 7-man oil shale advisory board to recommend Federal oil shale policy.

September 1964--Public Land Law Review Commission (PLLRC) was created to study existing laws and procedures governing the administration of public lands including oil shale lands.

September 1964--Federal Oil Shale Advisory Board met in public session at Anvil Points, Rifle, Colorado.

February 1965--Federal Oil Shale Advisory Board submitted an interim report to the Secretary of the Interior who released the report to the public and requested public comments.

May 1965--Senate Committee on Interior and Insular Affairs held hearings on oil shale to obtain Administration's views on oil shale development.

March 1965--The Secretary of the Interior announced formation of Interior Department energy group to assess prospects for petroleum supply between then and 1980 including the study of gas and liquid fuels from oil shale.

June 1966--PLLRC began a series of regional public meetings in Salt Lake City to obtain views on public land policy from all interested persons. Other regional meetings held in Denver and Albuquerque.

January 1967--Interior announced a Federal 5-point oil shale development program which, among other things, included provisional developmental leases of Federal land followed by commercial leases if research and development was successful.

February 1967--Senate Interior Committee held public hearings on Federal oil shale development program.

May 1967--Interior published proposed regulations governing oil shale leasing for research and development. Comments from the public requested.

April and May 1967--Senate Subcommittee on Antitrust and Monopoly held hearings on the competitive aspects of oil shale development.

September 1967--Senate Interior Committee held hearings to consider public response to proposed oil shale leasing regulations.

May 1968--After 8 months of study by an Interior task force, Interior released a report; Prospects for Oil Shale Development, which recommended a test leasing program. Three months were allowed for public comments.

May 1968--The Public Land Law Review Commission awarded a contract to Denver University for an oil shale legal study which was completed in July 1969.

September 1968--The 1968 oil shale leasing program was announced by Interior.

December 1968--The Secretary of the Interior announced that his Department has rejected as "...patently inadequate..." the three bids received in the test sale.

October 1969--Interior began studies leading to the present prototype oil shale leasing program. The events since that time have been documented in Chapter I of this Volume.

14. Technology Is Not Available

Technology is not yet available to develop oil shale and poor quality water, which would be used in the development and mining process, would increase salinity problems (114).

Response

Shale oil was produced in this country from oil shale prior to the 1859 discovery of natural petroleum. Efforts to develop oil shales of the Green River Formation in Colorado, Wyoming, and Utah, commenced in the 1920's and have continued intermittently to date. During this time, over 2 million tons of oil shale have been mined by the Bureau of Mines and by industry and several thousand barrels of shale oil and petroleum byproducts produced. The state-of-the-art of the technology is summarized in Volume I, Chapter I. This information shows that much of the technology has been reasonably

well demonstrated from actual mining and processing of oil shale and that what is needed now is a program to determine the feasibility for scale-up to commercial size, monitoring to evaluate the environmental impact, and proof of the effectiveness and reliability of environmental control systems. The prototype oil shale leasing program is designed to meet this need.

Available hydrologic data indicates that most of the oil shale mining operations (except for the Bluffs and the canyon walls) in Colorado will require dewatering and that the quality of the pumped water will range from fresh and potable to highly saline. Water of poor quality that is produced in excess of what is needed for mining, processing, or processed shale disposal would present a disposal problem. Several methods may be used to handle this water, such as desalination, evaporation, or injection into subsurface aquifers (See Volume I, Chapter III, Section C). Additional hydrologic data would be obtained for each tract during the period between lease issuance and the time of submittal of final detailed development plans for approval. Before the lessee commences any operations on the tract, he must submit a plan of operation and obtain the approval of the mining supervisor. This plan must include detailed descriptions of procedures that will be followed to assure that the operations will conform to the environmental requirements in the lease, including proper disposal of poor quality water. The entire question of salinity increases associated with oil shale development is discussed in Volume I, Chapter III, Section C.

15. Operation of an Open Pit Mine by the Federal Government

The Federal government should operate all phases of the open pit mining operation, disposal of processed shale and overburden, disposal of leachable salts, and land reclamation. Industry would process the shale in their plants on a royalty basis (103).

Response

The environmental impact associated with surface mine development would be similar to that described in Volume I, Chapter III, and Volume III, Chapter IV, regardless of who actually owns the mine. However, it is doubtful if royalties received from the shale would fully reimburse the Government for the capital investment and operating expenses of such a large operation; therefore, a subsidized industry would result. No taxes would be generated from a Government-owned plant and the likelihood of competitive development of improved mining technology - a necessary requisite for a commercial operation - would be reduced. In contrast, the prototype oil shale leasing program would stimulate the development of a commercial oil shale industry within the framework of existing industry competition, would provide a tax base for Federal, State, and local government, and would not be subsidized. The program provides for environmental studies and monitoring to assure all operations conform to all applicable Federal and State laws and regulations.

16. Demonstration Plant

Questions were raised concerning the feasibility of demonstration plants of commercial size, perhaps on tracts smaller than those proposed to be leased under the prototype leasing program (39, 215).

Response

A demonstration of technology by the Government is a feasible means often used when there are a number of competing technologies, none of which have been proven to be commercially viable, and it is in the national interest to accelerate technologic development. This alternative, including a discussion of lease size and environmental impacts, is analyzed in Volume III, Chapter IX, Section C. The alternative of leasing smaller-sized tracts is also discussed in Volume III, Chapter IX, Section H.2.

17. Number of Leases

Questions were raised over the selection of six prototype tracts, and suggestions were received that fewer tracts be offered for development, or that no tracts be offered until private lands had been developed first (23, 30, 32, 36, 37, 38, 44, 51, 57, 103, 109, 122, 123, 125, 127, 136, 141, 145, 150, 153, 156, 164, 172, 178, 179, 185, 207, 212, 293).

Response

The proposed six prototype tracts offer opportunity for alternative technical approaches between the Piceance Creek Basin of Colorado, the Uinta Basin of Utah, and the Washakie Basin of Wyoming, each of which exhibit unique depositional characteristics and ambient conditions. The alternative of fewer tracts is addressed in Volume III, Chapter IX, Section H; the alternative of private development first is considered in Section E of the same chapter.

18. Uses for Oil Shale

One comment cited the Committee on Resources and Man of the National Academy of Sciences as having stated that if, in the long run, the world's principle industrial energy requirements can be supplied by methods other than burning fossil fuels, it would be desirable to conserve the remaining fossil fuel resources for chemical uses. Additionally, if the oil shale petroleum or products are to be used for export, then perhaps it would not be worth mining the public lands for such a purpose (29).

Response

The development of technology sufficiency to supply other than by burning fossil fuels lies decades in the future. All projections indicate that this Nation will require increasing amounts of fossil fuels to satisfy our need for energy for at least the balance of this century. The volumes of fossil fuels used for chemical purposes should be small in comparison to the present and foreseeable future needs for energy.

Considering the fact that the United States is now importing over 25 percent of its total oil needs, it is highly unlikely that the United States will export shale oil. As documented in Volume II, Chapter II, our dependence on foreign sources is increasing at a rate of 750,000 barrels per day with each passing year. By 1985, the difference between what the Nation needs and what it can produce domestically is projected to be 13 million barrels per day and is to be largely supplied through oil imports. Thus, the probability of exporting oil supplies is virtually nonexistent in the foreseeable future.

19. Oil Shale is Insignificant

The estimated 1-million barrel per day oil production from both private and public oil shale land represents only 4 percent of the Nation's projected demand and is an insignificant amount (6, 7, 13, 18, 28, 34, 79, 83, 94, 118, 129, 132, 136, 158, 171, 173, 199, 202, 215, 230).

Response

A 1-million barrel per day oil shale industry would increase the Nation's domestic oil production from the 10-million barrel per day level forecast in 1985 to 11 million barrels per day. A 10 percent increase in self-sufficiency is not insignificant. Furthermore, the replacement of foreign oil with shale oil would reduce our balance of trade deficit by about $1.0 billion per year and eliminate 70 tanker arrivals per month in 1985.

20. Program Curtailment Pending Environmental Solutions

Concern was expressed over the ability of the Department to curtail development if severe environmental problems occur for which solutions are not yet available (7, 36, 83, 214, 231, 247).

Response

The government retains the right to initiate appropriate forfeiture proceedings and cancel the lease if the lessee fails to comply with any terms and conditions of the lease, or stipulations, including the terms and conditions of any development plan (See Volume III, Chapter V, Sections 22 and 29 of the proposed Lease).

This program was designed specifically as a prototype program in order to test the compatability of industrial development with environmental quality. As a prototype program, it is the mechanism through which actual environmental impacts can be assessed before any commitment is made to large-scale development on public lands.

At the same time that a company submits its bid for a tract it must also submit a preliminary plan describing the general type of development to be used and defining the steps that would be taken before choosing the final development plan. The company then has up to 3 years to develop and submit a detailed mining plan. During this interval, environmental data would be developed to provide additional baseline data against which the actual environmental impacts of development would be compared. Both the environmental data and the detailed plans will undergo public and governmental review before final approval. If, during the review, some aspect of the plan is found unacceptable for environmental reasons, the plan would be reworked and redesigned until the environmental criteria could be satisfied.

Each lease will contain environmental stipulations that define what can and cannot be done on each specific tract. These stipulations supplement local, State and Federal standards.

Once the mining plan is approved and development begun, the lessee will also be required to maintain extensive monitoring programs to determine the adequacy of their environmental protection measures. The monitoring will include wildlife surveillance as well as air and water quality measures.

If the lands for which leases were issued during this prototype program could not be developed in a manner consistent with environmental integrity, no development would occur and no further leases would be issued until environmental protection could be assured.

21. Effect of Mass Transportation on Automobile Usage

The statement made on Page 71 of Volume II that a doubling of the availability of mass transit over the next 15 years will reduce automobile usage by only 4 percent was questioned. A request for background data for that statement was requested. (36)

Response

The statement questioned is that quoted from reference number 11 in Volume II, Chapter II, Section A. The only background data for the statement given in the reference is that today, 14 percent of all commuters use public transportation and that commuting accounts for one-fourth of all passenger car usage. The reference then states that, "even if mass transit were to double in the next 15 years - which now appears highly unlikely - it would reduce total car usage by 4 percent and gasoline consumption by 3 percent." That this is not an unreasonable conclusion is shown in the expanded analysis of this subject given in the section referenced above.

22. Storage of Oil and Shut-In Capacity

A request was made for examination of the environmental impacts, economic feasibility, and timing of the alternatives of storage and shut-in capacity. Particular attention was asked to be paid to the

option of development of shut-in capacity on Federal Petroleum Reserves, at least as a partial solution to reliance on imported oil (36).

Response

Oil storage and shut-in capacity means to protect national security from interruptions in supply have been considered in Volume II, Chapter V, Section A.2. European countries have used storage for many years to protect the continuity of supplies. Significant storage capacity has not been needed in this country in the past due to the large amounts of shut-in capacity. As explained in Volume II. excess capacity has now disappeared and increasingly larger quantities of petroleum will need to be imported to satisfy projected needs. Thus, storage may well become an important future element in the Nation's efforts to protect national security.

Early in this century, four naval petroleum reserves and three naval oil shale reserves were established to assure the availability of fuel oil for the Navy. With the exception of NPR-1, Elk Hills, California, the naval reserves provide no short-term deliverability to meet emergencies. Even Elk Hills has shut-in capacity of about 160,000 BPD. The other reserves, NPR-2, Buena Vista Hills, California, and NPR-3, Teapot Dome, Wyoming, contain only 23 million and 50 million barrels of reserves, respectively. NPR-4 contains insignificant proved reserves, but is only a few miles west of the Prudhoe Bay field on Alaska's North Slope. It is therefore possible that NPR-4 might contain sizable oil reserves.

Oil storage and the shut-in capacity in Federal Petroleum Reserves cannot be considered alternatives to shale oil production for each is aimed at different objectives. The objective of shale oil production is to provide an additional domestic source of oil that can be used relatively soon, while the objective of storage and shut-in capacity is to provide national safeguards against interruptions in foreign oil supply.

23. Comparative Analysis of Environmental Effects

There is no comparative analysis of the possible environmental effects of the various alternatives, particularly for those alternatives, which were described as having impacts very similar to those described for oil shale (39, 42).

Response

The discussion of Energy Alternatives (Volume II) is organized to discuss each of the possible alternatives separately. Also, a major premise of the discussion is concerned with the "substitutability of energy forms", i.e., liquid-for-liquid, solid-for-solid, etc. While each of the topics, including environmental impacts, is discussed separately, the environmental impacts of an alternative can nonetheless be compared to those of the proposal or another alternative by cross-reference. It is highly unlikely that there will ever be a single definitive choice to be made between any potential energy form and its alternatives. Chapter V, Section C, of Volume II, points out that prediction of the relative roles of potential

alternatives and their combined environmental impacts, considering the multiple combinations possible, is a highly subjective exercise. Accordingly, the separate discussion of each alternative presented in Chapter V, together with its potential environmental impacts, is the most informative and meaningful form of analysis that can be accomplished at this time.

24. Biological Energy

Additional information was requested on the conversion of organic wastes to useful fuels. The 1.25 barrels of oil per ton of waste appears low. Improved technology reportedly increased oil recovery to two barrels (2).

Response

Agricultural and other organic wastes do have considerable promise for conversion to clean liquid and gaseous fuels; some 170 million barrels are potentially available from those wastes currently collected. The potential recovery from a ton of dry organic material is in fact two barrels, as indicated in the comment above. However, it requires about 0.75 barrels to provide power for the process. Thus, the net recovery from a ton of organic wastes would approximate 1.25 barrels. This net recovery may be expected to increase toward the ultimate potential, but considerable research remains to establish economics and the practicability of conversion on a commercial scale.

25. Magnetohydrodynamics (MHD)

The two paragraphs on page 190 of Volume II of the Draft Statement in the discussion of magnetohydrodynamics seem to be in some degree of conflict. Clarification is needed (1).

Response

Each of the two paragraphs identified by the question concerns a different subject. The first relates to higher efficiencies possible with MHD generators located near coal sources in the proximity of population centers. The second describes the major environmental impacts associated with the MHD alternatives. It is implies in the first paragraph that the lower fuel requirements (higher efficiency) will result in lower total volume of noxious emissions. In the second paragraph, it is noted that the higher combustion temperature associated with MHD will yield relatively high quantities of oxides of nitrogen (NO_x) in the generator exhaust. This apparent contradiction has been clarified by the statement that the lower total effluent derived from higher efficiencies must be evaluated against the potential increase in NO_x emissions.

26. Oil Shale Development on Private Lands

The Final Statement should include a comparative economic analysis of oil shale development on private lands versus oil shale development on private and public lands. An analysis should also be presented comparing the environmental controls applicable to public lands under a leasing program (7).

Response

Volume III, Chapter IX, discusses the alternatives of a Government corporation, a Government demonstration plant, or a Government/industry demonstration plant, no leasing or delay of leasing of public lands, development of private lands first, and open leasing. The reader is referred to that chapter for a complete discussion of these alternatives.

27. Federal-State Compact

Consideration should be given to the formation of a Federal-State compact between Utah, Wyoming, and Colorado, and the Federal Government, patterned after the Delaware River Basin Compact. The administrative body of such a compact should have planning, construction, operation, and enforcement authority (7).

Response

The Delaware River Basin Compact is an exception to most such compacts in that the Federal Government, as well as the concerned States, is a member and the administrative body has the authorities cited in the comment.

The three-State oil shale region is already subject to two compacts insofar as the Colorado River is concerned. They are the Colorado River Basin Compact of 1922, which involves 7 States, and the Upper Colorado River Basin Compact of 1948, which includes 5 States. These compacts, however, do not include the kinds of special authority suggested in the Comment alone. The Federal

Government, through the Secretary of the Interior, is responsible for the management of the Colorado River water and the various water projects, guided by formally adopted operating criteria for water and power. Any new compact would have to be compatible with, or supersede the existing ones. Enabling legislation and funding would be required which probably could not be justified until the need for such new agreement and the probability of mature oil shale development have been demonstrated. Any such approach would require extensive study and planning based on information of the type expected to be developed through the prototype program.

J. Lease Provisions

Any development of Federal oil shale resources will be pursuant to leases which will include special provisions and stipulations designed solely for the prototype program. The authority for leasing is the Mineral Leasing Act of 1920 (44 Stat. 445), as amended (30 USC §§ 181-263).

Comments on this aspect of the program and the responses are considered in the following order: Those pertaining to the general leasing plans and limitations; the basic lease provisions; and the special stipulations. The proposed lease including the special stipulations is reproduced in Volume III, Chapter V.

1. Lease Size

The statutory limitations of a single oil shale lease of not more than 5,120 acres should be raised to no less than 10,240 acres for an individual company per state excluding acreage under development (72).

Response

Raising the single lease limit and the oil shale lease acreage limitation has been discussed at some length, and the Department in February 1973 proposed legislation to increase the acreage which may be held by one party in a state to 10,240 acres. No increase in the size of a single lease was proposed. Larger acreage may well be needed for economically viable development in areas of lower oil shale resource value. However, the Department does not believe that

amendatory legislation to raise the limitations is required for the prototype program Nevertheless, the issue should be reviewed in the event any further leasing is considered. Further discussion of this is found in subject Volume III, Chapter IX, Section H.

2. Sequence of Offering Lease Tracts

The proposed sequence in which the tracts are to be offered for leasing should be revised so that both Colorado tracts would be offered in successive lease sales first, then both Utah tracts, and finally the two Wyoming tracts, in accordance with the descending order of presumed bidder interest (33, 38, 53, 177).

Response

The proposed sequence of tract offerings has been revised in accordance with these suggestions (Volume IV, Chapter I, Section C). This sequence is in accord with the approximate percentage distribution of tracts nominated: 65 percent in Colorado, 20 percent in Utah, and 15 percent in Wyoming. By offering the higher interest tracts first, competition for the remaining tracts should be maintained as unsuccessful bidders reassess their positions and the development prospects for the remaining tracts.

3. Withdrawal of Colorado Fish and Game Lands

In Colorado, specific attention must be given to the withdrawal of those lands in which surface rights are owned by the Colorado Division of Wildlife. Over 30,000 acres of such land exist in the Piceance Basin, most of it purchased with Pittman-Robertson funds, for deer winter range. As presently plotted, Colorado lease

Tract C-a's boundary includes approximately 680 such acres (38). One party commenting understood that wildlife management areas would be excluded from development (23).

Response

The surface of 520 acres of lands in Tract C-a are owned and managed by the State of Colorado. They were patented originally to private parties under homestead laws with minerals (including oil shale) reserved to the Federal Government together with the right for their extraction. A mineral lessee on such lands is required to indemnify the surface owner for damage to crops and improvements. However, until leased lands are actually included in the area of mining operations, they are not normally removed from their pre-existing use and management. Upon completion of operations or termination of the lease, the surface of the lands would be restored to full use and management by the surface owner. His title to the surface is undiminished.

The Federal Regulations (50 CFR 80.5) which pertains to lands purchased with Pittman-Robertson funds cover the situation where other uses are proposed by the State for lands,acquired under the Pittman-Robertson Act. In this case, however, it is the Federal Government proposing the varying use, so that no question of diversion of funds by the State would be involved.

The oil shale program provision for exclusion of lands that have a greater value for other uses or that present

associated environmental hazards which cannot reasonably be met or overcome at this time specifies that critical fish and game experimental or management areas would be excluded.

Should the lands in Tract C-a not be leased, the withdrawal question becomes moot. Should the decision be made to lease Tract C-a, possibilities or options exist:

a. The underground mining method may be selected. If so, the surface should not be disturbed by mining, and steps could be taken to locate surface facilities and disposal areas away from the lands in question.

b. The tract boundaries could be redrawn prior to leasing to exclude the 520 acres.

c. Since the State will retain surface title to any such lands included in an oil shale lease, it could exchange them for other lands of equal acreage and equal or greater value for wildlife purposes. The exchange provisions of the Taylor Grazing Act (43 USC §§ 315) govern State-initiated exchanges.

Preliminary discussions between Colorado State officials and the Department indicate that a satisfactory solution can be worked out. The needs of the Colorado Division of Wildlife will be considered in this matter.

4. Depletion Allowance

The depletion allowance for oil shale should be raised from 15 percent to that provided for natural crude oil, 22 percent, and the allowable credit limitation for depletion of 50 percent of taxable income should be removed because of marginal shale oil economics and to encourage development (72, 168).

Response

The establishment of depletion allowances and their application are clearly matters for Congressional consideration. It should be noted that the Tax Reform Act of 1969 provided a potential increased tax allowance of about 15 cents per barrel (Volume II, Chapter III, Section B) which has helped to improve the economics of shale oil. It is assumed that this program can proceed under existing tax laws. Experience gained in the prototype program may indicate the need for further consideration of the matter at some future date if additional leasing takes place.

5. Disposition of Funds from Bonus Bids

A way should be found "to plow money received by the Government in the form of bonus bids back into the oil shale program" (208).

Response

Section 35 of the Mineral Leasing Act, as amended (30 USC §§ 191), provides that all receipts from leases of oil shale and other minerals under that statute (except from leases in Alaska) shall

be distributed as follows: 52½ percent to the Reclamation Fund; 37½ percent to the State within the boundaries of which the lease is situated for roads and public education; and 10 percent to the miscellaneous receipts of the United States Treasury. Any change would have to be through legislation.

6. Rental Rate

Several comments criticized the annual rental rate of 50 cents per acre as being too low, contrasting it to land sales prices (18, 49, 136, 153, 158, 168, 178, 191).

Response

The annual rental rate of 50 cents per acre is established by Section 21 of the Mineral Leasing Act (30 USC § 241) and represents only one part of monetary return to the Federal Government, the others being bonus payments and royalties on shale oil and other products of oil shale. The bonus payments would be completed by the fourth anniversary date of the lease year. Beginning with the sixth year, minimum royalty payments would be required. The minimum royalty rate for each lease year would be based on a hypothetical minimum production for that lease year which, in turn, would be based on the estimated reserves on the lease. Consequently, the rate would be different for each of the proposed prototype leases. The minimum cost of holding a lease containing 2.1 billion tons of recoverable 30 gallon oil shale would be about $16 million over a 20-year period. The bonus bid payments will be additional. Of course, a lease may be terminated before the end of the 20-year period, and payments could thus be less.

The Federal Government retains use and management of the leased lands outside the area of operations and on the lands included in the oil shale leases would retain the right to issue leases for other minerals or nonconflicting uses as well. Upon completion of the operation or expiration of the lease, the Federal Government regains full title and use of the lands.

7. Shale Oil Royalty Rate

Criticisms were made to the effect that the royalty rate for shale oil provided in the proposed oil-shale lease is too low and also that it is too high (18, 168, 221, 249).

Response

The royalty rate for shale oil, which is 12 cents per ton of mined 30-gallon-per-ton oil shale, has been calculated to equal the average rates for other leasable minerals at the point of extraction of the resource from the ground. The gross value of the mined rock is calculated to range from 60 cents to $1 per ton. The Department has attempted in the proposed lease provisions to balance the lease terms and provisions to encourage development and produce a fair return to the government. For example, the amount of royalty which would be paid on an operation producing 50,000 barrels per day during a 20-year period at a royalty rate of 12 cents per ton of 30-gallon-per-ton oil shale would be about $65,000,000. It is believed that the level of bonus bids will tend to compensate for any variations in the royalty rate, i.e., a lower royalty rate would be reflected by higher bonus bids, and a higher rate would

induce lower bids since total resource value to the government is reflected in the combination of both bonus and royalty value. An excessively high rate could, of course, prevent development entirely. The Department is not committed to this rate for any leasing beyond that of the prototype program.

8. Royalty Rate for Minerals other than Shale Oil

The applicable royalty rate for minerals other than oil shale, produced from the oil shale, beyond the 20th year of operation was questioned (1).

Response

The royalty rate for minerals produced from oil shale, other than shale oil, was designed as an escalating incentive royalty through the primary 20-year term of the lease. The lease would continue in force beyond that term only as long as there is production of the leased minerals in paying quantities.

The royalty rate for the other minerals, as well as for shale oil, and other lease terms and provisions, would be subject to adjustment at the end of each twenty-year period to reflect conditions and requirements at that time.

9. Length of Lease and Adjustment of Lease Terms

A twenty-year lease term is too long. In any event, the Department should be able to adjust lease terms as often as every 5 years (36, 168).

Response

The provision for adjustment of royalty terms in leases at 20-year intervals is contained in Section 21 of the Mineral Leasing Act (30 USC § 241). The Department thus has no discretion to adjust

royalty terms at 5-year intervals under existing law. The terms of leases under that act for certain other minerals, such as coal, are, by statute, subject to adjustment at fixed intervals, such as 20-year periods. Although the statutue does not specifically authorize the adjustment of the terms of oil shale leases, except for royalty provisions, the Secretary is given such broad discretion with respect to the terms of oil shale leases that the inclusion of a general adjustment provision appears authorized. Since the statute has already set 20 years for the adjustment of royalty terms, it seems appropriate to use that period for the length of the initial lease and for the adjustment of other terms also. Any shorter period would appear to create a condition of uncertainty which might deter lessees from the expenditure of the sums needed for the development of an oil shale facility. The proposed environmental stipulations, however, could be revised or amended at any time to adjust to changed conditions or to correct an oversight. In addition, compliance with all applicable State and Federal regulations will be required, and standards promulgated in the future must be met.

10. Multiple Mineral Development

The proposed lease does not specifically provide for compatible development of other minerals which may be present on the leased lands (235).

Response

Section 3 of the lease (in Volume III, Chapter V) provides explicitly that the right to dispose of other minerals in the lands subject to the

oil shale lease is reserved to the United States. Multiple mineral development is specifically provided for in the Act of August 13, 1954 (30 USC §§ 521-531). The oil shale lands have been withdrawn from leasing and disposal since 1930 (Executive Order 5327, April 15, 1930). That withdrawal has been modified to provide for the leasing of oil and gas and sodium minerals. The lease provides for the extraction from oil shale deposits of both shale oil and other minerals. Separate royalties will be charged on shale oil and on other minerals extracted from oil shale deposits. (See the definitons of "Leased Deposits" and "Oil Shale" in Section 1 of the lease and Section 7(a)(1) and (2) on royalty rates.) Oil and gas leases already cover much of the area with clauses designed to protect the oil shale resources.

11. Credit of Extraordinary Environmental Costs Against Royalties

Several comments were submitted opposing this provision (32, 39), two were favorable (208, 276), and one recommended clarification (7, 38).

Response

This provision is designed to give the Secretary discretion to take action where the economic viability of a lessee's operation is threatened by costs which were not in the parties' contemplation at the time of the issuance of the lease. Discretionary authority of this type is needed for a program concerned with such a new subject as oil shale development where costs are uncertain. To issue an oil shale lease containing terms so difficult as to make development uneconomical would be incompatible with the objective of

developing a viable oil shale program. Providing the Secretary with discretionary authority to permit the offsetting of unexpected environmental costs is one way of assuring the attainment of satisfactory environmental protection and development progress. The provision has been devised specifically and only for inclusion in the six leases proposed for this prototype program and solely as an effort to promote the development of a presently nonexisting industry. There is no intention to include such a provision in any subsequent oil-shale leases, nor in leases covering other minerals which are utilized in established industries.

This section of the lease has been revised to clarify the provision (Section 7(d) of Lease, Volume III).

12. Office Nomenclature

The terms "Land Office" and "Manager, Land Office" are no longer the correct titles for the BLM offices and officials with which applications and other papers are filed in connection with public land matters (2).

Response

The terms "Land Office" and "Manager, Land Office" have been deleted and "Bureau of Land Management State Office" has been substituted in all pertinent lease sections.

13. Compliance with Executive Order 11593

The Draft Statement failed to indicate compliance with Executive Order 11593, which pertains to protection and enhancement of the cultural environment. Specifically cited was the

requirement in Section 2(a) of the Order for survey of Federal land to identify sites or objects that may qualify for listing in the National Register or historic places (9, 42, 289).

Response

Compliance with the intent of Section 2(a) of the Order has been achieved for the least tract areas by a qualified archeologist through field examination and literature search and examination of records and consultation with knowledgeable professional personnel of the National Park Service and State universities and museums. The results of this review revealed no sites or objects of historic or scientific interest on the least tracts appear in the Statement (Volume I, Chapter II, and Volume III, Chapter II.)

Section 2(b) of the Order requires the exercise of caution during the interim before Federal agencies complete their inventories to assure that Federal property that meets the test will not be "inadvertently transferred, sold, demolished, or substantially altered." Section 6 of the special stipulations provides for professional investigation prior to construction or mining to determine if objects of historic or scientific interest, such as archeological remains not now known, do in fact exist on the leased tracts.

14. License Technology and Make Patents Available

The lessees should be required to license their technology and to make their patents available to others (30, 39).

Response

Oil shale processing is not a unique operation where only one method is likely to be economic. With the development of several acceptable methods, competition among patentee-lessees would undoubtedly lead to reasonable licensing rates, particularly in light of the competition from other sources of petroleum and the maximum acreage limitation of 5,120 acres of oil shale lands allowed to any one person, association or corporation. The intent is to create the conditions that would help assure the development of several competing economic technologies. Experience has shown that new technology is developed most rapidly when those engaged in development are assured of material rewards for their endeavor. None of the mineral leasing laws provide for licensing requirements, and we are unaware of any instance in which the Department has included such requirements in any lease issued under those laws. Such a requirement would be outside the scope of the Government's patent policy as contained in the President's Memorandum, and Statement of Government Patent Policy (36 FR 16887), which is keyed to Government-funded grants and contracts for the conduct of research and development.

15. Authorized Officer of the Department of the Interior

Section 2(h) of the proposed lease has been criticized as limiting Government inspection and investigation of the leased premises to only Interior Department staff with the thought that environmental type inspections by other Federal or State Officers would at some time be desirable. It was suggested that the phrase "or representative" be added to the section (7).

Response

The suggested change has been made in Section 15 of the lease (Volume III, Chapter V).

16. Stipulation Compliance Provisions in Lease

The requirement for compliance with lease stipulations contained in Section 11 of the proposed lease should be written into other sections of the lease concerned with protection of the environment (39).

Response

The provisions of Section 11(c) of the lease are specific as to the required compliance with the oil shale lease environmental stipulations and make the stipulations a part of the lease so that they have the same force and effect as other lease provisions. Further reference to them in the lease could make them no more binding.

17. Provision for According Preference in Securing Oil Shale Leases

The Department should provide that companies without adequate oil shale reserves be given priority in securing Federal oil shale leases (61).

Response

Section 21 of the Mineral Leasing Act, as amended (30 USC §§ 241) does not provide a priority for any party based on its need for reserves but instead gives the Secretary broad discretion in the method used for the issuance of oil shale leases.

Competitive leasing is merely a method for determining which applicant will receive a lease, once the decision has been made on the tract to be offered for lease and the terms of the lease. The Department is under directive from the Executive Office of the President to obtain fair market value for all leases issued. It has generally been found that competitive bidding is the best method of obtaining that fair market value. To require competitive leasing of known deposits of oil shale will be consistent with provisions of the Mineral Leasing Act applicable to minerals other than oil shale, as administered by the Department; for example, lands known to contain valuable deposits of coal, sodium, potassium, and phosphate are leased only through competitive bidding, except where the deposits have been discovered under a prospecting permit for that mineral, and in such a case, the permittee may receive a preference right lease.

In both October 1971 and February 1973, the Department submitted to the Congress proposed legislation to revise the Mineral Leasing Act which would require competitive leasing for oil shale. These legislative proposals were submitted as Administration bills. Thus a policy of competitive leasing for oil shale has already been adopted by the present Administration. No reason is evident why the Department should depart from this policy to give priority to companies without reserves. The Department's purpose in issuing prototype leases is to ascertain the practicability of a commercial oil shale industry, and, as long as an applicant is legally qualified, the Department sees no need to give any right of preference.

18. Protection of Proprietary Rights of Lessees in Process Technology

Specific provisions should be included in the lease to protect the proprietary rights of lessees with respect to processes and related confidential technical information (67).

Response

The Department must have access to all technical data in order to carry out its responsibilities to insure compliance with lease terms and stipulations, including those concerned with health and safety, environmental measures, resource conservation, royalty rates and production data. However, proprietary information or reports containing such data will not be disseminated to third parties or reproduced and will be identified as "proprietary-confidential" as is the practice with such data from other leasable mineral operations.

19. Right of Lessor to Waive Breaches of Lease Conditions

Objection was made to this provision (Lease Sec. 3(c)). Specific criticism was directed at the failure to make explicit the party having the authority and the absence of a provision for public notice of breaches or intention to waive (39).

Response

Despite what was written in the lease concerning waiver, the Secretary would always retain the right to waive a requirement of the lease, provided that the requirement waived was not one imposed by statute. The proposed lease form does not give the lessor an express right of waiver, or any right to waive lease provisions

which he would not otherwise have, but merely provides that a waiver of any particular breach will be limited to that specific breach at that specific time and will not be a precedent in the event of any future breach. The waiver provision is thus designed to protect the interests of the United States.

Such provisions are standard in leases but are not widely exercised. The Department believes this flexibility is necessary at the field level and the responsible official will be the mining supervisor.

20. Thirty-Day Default Provision

This provision (Lease Section 29) permits the government to suspend operations if an operator remains in default in the performance or observance of lease provisions for a period of 30 days after written notification thereof. It was commented that a lessee should not be allowed to continue operating in default for that long a period (39).

Response

This is a standard leasing provision and similar to one imposed by statute in connection with oil and gas leases under the Mineral Leasing Act. This provision would form a reasonable basis for legal action to cancel a lease or forfeit a bond, which might become necessary. It is also considered to provide a reasonable

period in which corrective action can be taken by the lessee. However, under Section 22 of the lease, in an emergency situation the lessor may suspend operations immediately and under Section 29 may enter the premises and take necessary remedial action at the expense of the lessee.

21. Minimum Bond Provisions

Several comments were received recommending increases in the minimum per acre bond rate and the minimum bond level pertaining to protection of the environment, other resources, and reclamation, as provided in Section 11 of the proposed lease (30, 39).

Response

Review of available cost data indicates that rates should be raised for spent shale disposal and actual mining areas. That section of the lease has been revised to provide for a bond for the first three lease years following approval of the development plan in the minimum amount of $2,000 per acre for those areas while maintaining the $500 per acre minimum for other lands involved or disturbed. The minimum bond for a lease has been raised to $20,000. No monetary figures are specified for the bond applicable after the first three years following the approval of the development plan, but the bond shall be in such a total amount as to provide for the reclamation and restoration of all leased lands affected by operations under the lease. Moreover, a new provision has been included in Section 9(c) requiring a bond in the minimum amount of $20,000 prior to approval of the development plan.

22. Stipulations - Off-Road Vehicle Use

It was suggested that the phrase "...issued in accordance with Executive Order 11644," be added to stipulation Section 2(N), which reads "The lessee shall use off-road vehicles in a manner consistent with applicable regulations" (7, 39).

Response

The suggestion has not been adopted. As written, the stipulation includes all applicable regulations whether issued pursuant to Executive Order 11644 or under some other authority.

23. Stipulations - Waste Disposal

Two comments were received opposing proposed stipulations 3(A)(2)(a) and 8(C) in that they allow the possibility of burning rubbish, trash, waste, or debris under lease stipulations 3(A)(2)(a) and 8(C), (2, 7).

Response

It is recognized that controlled burning must be allowed in some situations. However, the specific provisions allowing the possibility of burning have been removed by the elimination of subsections 3(A)(2)(a) and 8(C) of the stipulations. Disposal of all waste other than mine waste will be subject to Section 14(B) of the stipulations.

Subsection 3(A)(2)(a) also pertained to the use of explosives, but explosives are adequately covered by Subsection 5(C).

24. Stipulations - Authority of the Mining Supervisor Under the Antiquities Act of 1906

The mining supervisor has not specific authority under the Antiquities Act to authorize destruction of any object of historic

or scientific interest as implies in Section 6(B) of the lease stipulations (9, 42, 289).

Response

Section 6(B) of the stipulations prohibits the lessee from destroying any object of historic or scientific interest. Where a question exists as to whether an object is of such a nature, the lessee must report to the Mining Supervisor. The supervisor is required to inform the lessee of the determination. Section 6(B) does not provide that the supervisor will make the determination; the section is designed so that the supervisor will obtain the determination from the proper officer. Instructions for consultation with the National Park Service, when such questions arise, will be issued so that compliance with the Antiquities Act is assured (Volume III, Chapter V).

25. Stipulations - Spill Contingency Plans

The term "oil spill" in Section 7 of the Stipulations should be expanded to "oil and hazardous substance spills" as defined in Section 311 of the Federal Water Pollution Control Act Amendments of 1972. It was also recommended that along with the Spill Contingency Plans, the lessee should be required to submit an oil and hazardous substances spill prevention plan (7, 8).

Response

The suggestions have been partially accepted and incorporated into Section 7 of the stipulations.

The term "oil spill" has been changed to "spill" and defined as the spillage of oil, hazardous substances, and pollutants.

The lessee will be required to include a section in the spill contingency plans outlining positive efforts toward spill prevention.

26. Stipulations - Parameters to be Monitored and Baseline Data

The lease stipulations requiring an environmental monitoring program should specify the parameters to be monitored and provide for the collection of necessary baseline data (2, 59).

Response

The stipulation requiring a monitoring program (Sec. 1(c) of the stipulations, Volume III, Chapter V) has been revised and expanded to specify the environmental parameters to be monitored and to require that a minimum of two full years of baseline data be collected, one full year of which shall be prior to the submission of the development plan.

27. Stipulations - Approval of Fish and Wildlife Mitigation Measures

Several parties have criticized Section 4(B) of the lease stipulations for not requiring affirmative action by the mining supervisor on proposed measures, but rather providing that, if there is no response within 60 days, the plan will be deemed approved (36).

Response

The stipulation has been modified to provide for written notification from the mining supervisor, within 60 days of the submission

of the proposed measures of either approval or disapproval; if the supervisor disapproves, he must afford the lessee an opportunity for consultation at which the Mining Supervisor shall propose necessary changes without which there will be no approval.

28. Stipulations - Reporting on Compliance

Reports should be required regarding compliance with the lease stipulations and they should be made public (30, 39).

Response

Section 10(c) of the lease requires annual progress reports describing the operations conducted under the approved development program. That detailed development program must include among other requirements the procedures devised to comply with these stipulations. Therefore, the progress reports will cover that aspect. Section 1(C) of the stipulations further requires that a monitoring program be part of the detailed program and has been revised to require specifically that annual reports of the monitoring program be subject to public inspection.

29. Stipulations - Review of Development Plans

Detailed development plans should be reviewed by other Federal, State, and local authorities, and the public (7, 30, 38, 39).

Response

Section 10 of the lease requires the review and approval of the detailed development plan by the Mining Supervisor prior to commencing operations under that plan. The proposed Secretarial Order (see Chapter I, Section G of this Volume) will require the plan to be

submitted to the members of the Technical Advisory Board for review and comment on behalf of their agencies, prior to approval of the plan by the Mining Supervisor. In addition, the order requires the Mining Supervisor to conduct a public hearing on the environmental aspects of the plan, with the assistance of the Technical Advisory Board. Such hearings will enable State and local authorities to be heard as well as individual citizens.

30. Stipulations - Amendment or Revision

Several objections were raised regarding the provision (Section 1(B) of stipulations) for changes in the stipulations by mutual consent of lessee and Mining Supervisor (7, 32, 33, 39, 44) and it was suggested that such changes should be approved only by the Secretary of the Interior (33).

Response

The purpose of this provision is to permit the stipulations to be amended to reflect changed conditions or improved environmental control technology or to correct some oversight, thereby enhancing the overall effectiveness of the environmental protection measures. It is based on specific provisions in 43 CFR Part 23.7(f) for revision of mining plans. The modification of provisions cannot in any way relieve the lessee of the duty to comply with all applicable environmental protection and control laws. To provide for arbitrary revision of stipulations by the government would be inequitable. To require approval of all such revisions by the

personally would be time-consuming and a restriction of needed flexibility at the field level. Appeals or objections to an action by the Mining Supervisor may, however, reach the Secretary for ultimate decisions as set forth in Chapter I, Section G of this volume.

31. Stipulations - Underground Disposal of Spent Shale

The stipulations should require underground disposal of spent shale (32).

Response

It would be inappropriate to restrict or limit types of development or disposal techniques at this time. The program is designed to retain flexibility for the purpose of review and evaluation of oil shale development. Methods of disposal must be approved by the Mining Supervisor.

32. Stipulations - Adoption of State Environmental Quality Standards

State environmental standards, derived from oil shale studies, should be adopted and incorporated into the stipulations (7, 23, 33, 38) or the Department should wait for new standards to be adopted by Congress (18, 39).

Response

The lessee must comply with all applicable laws and standards, including those established by State or set by the Federal Government, and so any standards would, through the stipulations, be made effective upon establishment.

33. Stipulations - Enforcement

The adequacy of provisions for enforcement of the stipulations has been questioned (30, 39).

Response

The stipulations become part of the lease, a legally binding contract. In the event of noncompliance with the stipulations, just as in the event of noncompliance with other lease terms and conditions, the Secretary may suspend operations, initiate action for the forfeiture of bonds, and, if continued without correction, seek cancellation of the lease. Such provisions in other leases are generally adequate enforcement tools.

34. Stipulations - Revegetation Standards

Objection was made to Section 11(L), providing for optional standards for revegetation. This determination should reside with the lessor (2, 7, 36, 39).

Response

The revegetation stipulation has been revised to require the lessee to restore the vegetation of disturbed areas by reestablishing permanent vegetation of a quality which will support fauna of the same kinds and in the same numbers as those existing at the time of submission of the detailed development plan under the lease, unless a decision has been made that the leased lands will, upon the termination of the lease, be put to a different use from that to which they were devoted immediately prior to the issuance of the lease and, if he so determines, the Mining Supervisor may require the lessee to revegetate the land to meet that objective, except that the lessee shall not be required to expend more money than that needed to meet the first revegetation standard.

The lessee shall demonstrate at the time of submission of the detailed development plan under the lease that revegetation technology is available to enable him to provide the required revegetation of the disturbed areas. If this cannot be demonstrated, the lessee shall initiate a revegetation program approved by the Mining Supervisor at the start of production to (1) delineate those parameters necessary to establish vegetation at a specific location, and (2) show that successional changes in vegetation are compatible with the above requirements. Further details are in Section 11(L) of the lease stipulations in Volume III, Chapter V.

35. Stipulations - Mining Supervisor Authority

Objections were expressed regarding the authority and discretion given the mining supervisor and questions raised regarding his qualifications with respect to other disciplines related to the environmental aspects of oil shale development such as fish and wildlife protective measures and revegetation (2, 23, 25, 30, 32, 33, 39, 42, 44, 145, 247, 285).

Response

After a lease is issued the responsibility for Federal supervision of the operations is clearly lodged in the U.S. Geological Survey and the mining supervisor is the designated field official for that bureau. For the leased lands outside the area of operations, the responsible field official is the Bureau of Land Management District Manager. It is considered preferable that the operator have one responsible Interior official to deal with in regard to the resources and management of these specific leased lands.

The limitations of staff and individual expertise make it a necessity that the Mining Supervisor consult with other experts in order to carry out his responsibilities. The Technical Advisory Board has been established to provide a multidisciplinary and inter-agency body to advise in developing and planning this program after initiation should it occur. The opportunity for public review before development is provided in the planned public hearings on the detailed mining and development plan prior to approval. After development begins, annual reports on the monitoring program will be released.

36. Stipulations - Standards of Accomplishment

A number of criticisms were made regarding stipulations which modify performance requirements with words and phrases, such as "where possible," "reasonable," and "to the extent practicable." It was asserted that such terms are not sufficiently exact to insure adequate environmental protection (30, 39, 68).

Response

In some sections these provisions have been modified to require performance in accordance with approved exploration or development plans. Those plans will themselves contain the specific procedures to ensure environmental protection. However, in other places, the terms have been retained and it is believed that they will be legally effective.

37. Stipulations - Self-Monitoring by Lessees

Objections were raised regarding the provisions in Section 1(C) of the stipulations for the lessees to perform the environmental monitoring of their own operations rather than its performance by a government agency (30, 36, 42, 44, 73).

Response

There is no single Federal or State entity authorized, staffed, and funded to monitor all environmental aspects of an individual development and, in any case, the concerns and responsibilities of agencies such as the Environmental Protection Agency are on a broader scale than single 5,000 acre tracts of land. Agencies with specific environmental responsibilities will be checking to make sure that applicable antipollution standards are in fact met. However, the responsibility to comply lies with the lessee, and it will become essential that he monitor his own activities to insure compliance. Monitoring records will be subject to Federal inspection, and annual reports will be released for public inspection.

38. Stipulations - Alternatives

Alternative stipulations should also be released for public review in addition to those proposed by Interior (30, 38).

Response

Environmental stipulations to supplement and better define the regulations under which development should take place were considered desirable for the prototype program. Each stipulation contained in

the proposed draft statement was designed specifically to achieve certain environmental objectives. The Department carefully considered each of these points and the various representatives arrived at a common understanding and agreement for the total objective. The public hearings and review process provided considerable comment and discussion upon which to revise and clarify the meaning and intent of the stipulations. Presented originally was the Department's best judgment of what should be contained in the stipulations. The stipulations have been in places modified, clarified, or amplified when further study or public comment has indicated the need for such changes.

39. Stipulations - Participation in Environmental Briefings

The specific agencies which would participate should be identified (7).

Response

The precedent for such environmental briefings and this approach is the Trans-Alaska Pipeline stipulations. The Mining Supervisor is the Federal official responsible for supervision of the lease operations and he will determine who should participate in the briefing, which will no doubt vary from time to time. He will have the assistance and advice of the Technical Advisory Board in the arranging for, and the conduct of, these briefings. It does not seem desirable to specify in the lease what agencies will be asked to participate in these future briefings.

40. Stipulations - Disposition of Overburden

Detailed requirements should be included in the stipulations with regard to the handling of overburden during any surface mine development, including method, timing and location of stockpiling or other placement (39).

Response

It would be impractical to specify such detailed requirements without knowing that a tract would be so mined and in the absence of the detailed mining plan. Mining system design cannot be determined until a lease is obtained, detailed data developed on the deposit and the decisions made on mining and processing methods and plant location. Proposed disposal techniques cannot be evaluated until the detailed development plans are submitted.

41. Stipulations - Revegetation Requirements

Revegetation requirements should be less stringent to allow for possible open pit slopes that may be too steep to revegetate (68).

Response

Until development plans are submitted it is not known whether this could be a problem. If pits are to be backfilled, revegetation on the open pit slopes should not become a problem. However, the Department of the Interior is committed to requiring rehabilitation of all disturbed lands and does not feel that those requirements should be modified. Mining plans may have to be changed to comply with such requirements.

42. Stipulations - Revegetation of Wildlife Habitat

Mineral developments should not be allowed in key wildlife habitats such as Piceance Creek Basin mule deer winter range until explicit performance standards and time schedules have been set for reseeding wildlife food and cover plants and until it has been reasonably demonstrated that the lease stipulations can be met (50).

Response

The regulatory framework set forth in the proposed lease and stipulations provide definite goals for revegetation, rehabilitation, and mitigation of environmental impacts. Within this framework, the formulation of specific performance standards and time schedules for reseeding wildlife food and cover vegetation and other environmental controls would be required prior to the commencement of mining activities (See Section 10 of the lease, and Section 4(B) of the stipulations, Volume III, Chapter V). Under the terms of the lease, actual tract development could not occur until the detailed development plan has been approved by the Department's Mining Supervisor. Although formulated by the lessee, the mining plan will be reviewed by scientists from all involved agencies. Prior to approval of the detailed development plan, specific commitments by the lessee will exist by which the proposed stipulations would be met.

43. Stipulations - Contaminant Levels

The lease stipulations should specify permissible contaminant levels (267).

Response

The lease stipulations require the lessee to comply with all applicable Federal and State air, water, and noise quality standards. Since those standards specify allowable levels, it is unnecessary for the lease to do so. Specification in the lease might be in conflict with applicable standards in the relatively near future and it appears better to require compliance with all applicable standards, present and future.

44. Stipulations - Use of "Best Control Technology"

A request was made that a statement be included in the stipulations to provide that the best technology that is available be employed for the control of all air pollutants. The respondent further requested that provisions should also be made for ambient air surveillance systems that will provide data to monitor air quality at each development site in the area (7).

Response

Section 8 of the oil shale lease environmental stipulations on air pollution states that, "the lessee shall utilize all facilities and devices in such a way as to avoid or, where avoidance is impracticable, minimize air pollution." This statement implies that the best available control technologies must be employed to "avoid" or where avoidance is impracticable, "minimize" air pollution. The stipulations further state that, "at all times during construction and operation, lessee shall conduct its activities in accordance with all applicable air quality standards and related plans of

implementation adapted pursuant to the Clean Air Act, as amended (40 USC § § 1857-1857-1), and applicable State Standards."

45. Stipulations - Dams and Conduits

A criticism was expressed that the stipulations in Volume III do not mention dams and conduits which might be used to control flash flooding. The request was made that statements of assurance which mitigate environmental impact should be carefully reviewed for follow-up performance in the stipulations (8).

Response

Although specific techniques of control of runoff are not specified in the stipulations, they clearly require that adequate measures be taken to prevent erosion and water pollution. Pertinent sections of the revised stipulations are Section 9, Pollution-Water, particularly subsection (C) Control of Waste Waters, and Section 14, Waste Disposal, particularly subsections (D) Impoundment of Water, and (E) Slurry Waste Disposal. System designs and plans for operation are subject to federal review and approval at which time their adequacy will be carefully evaluated. Detailed requirements for methods of control are deemed to be less desirable than setting standards of accomplishment with the provision for review of proposed methods.

46. Stipulations - Rare and Endangered Species

Concrete plans must be outlined to assure perpetuation of rare, endangered, and threatened wildlife (38).

Response

The proposed lease, including the environmental stipulations (Volume III, Chapter V), is designed to avoid, or, where avoidance is not practicable, to minimize adverse impacts of development on leased tracts and on off-tract lands, which would also be developed. Stipulation 4(A) (Fish and Wildlife Management Plan) requires preparation of a detailed plan, including standards, techniques, and schedules for avoiding or mitigating adverse effects on fish and wildlife. As part of the detailed development plan, it would have to be prepared and approved prior to commencement of actual development operations on any leased tract. Such plans would be reviewed in the planned public hearings. The plan would include management steps to protect fauna, including any rare and endangered species which monitoring may show inhabit or use the site or the vicinity. Collection of base line data and the predevelopment monitoring recrod will provide the basis for any specific requirements for protection of rare, endangered, or threatened species. A large number of other stipulations are also pertinent to rare and endangered species. For example, Stipulation 2(I) would minimize loss of hawks, eagles, and other birds from electrocution on power distribution lines, and 7(E) would minimize the entry of herbicides and pesticides into the ecosystem.

47. Stipulations - Overseer Committee

An "overseer" committee should be established to review and approve development under these prototype leases (267).

Response

The program will not usurp existing and legally established authorities. For the Department the legally established responsible official is the Mining Supervisor. The Technical Advisory Board will serve as an advisory committee to him, but it is not considered workable or proper to shift authority to a committee which does not have the responsibility which is vested in the mining supervisor.

48. Role of Small Companies; Increased In Situ Research

Small companies would be disadvantaged under a competitive leasing system; in situ technology should be accelerated (21, 53, 55, 60, 61, 63, 65, 71, 76, 209, 238, 266).

Response

The general reasons for adopting a competitive leasing system are discussed above in J-17. Small companies which found themselves at a disadvantage in competing for leases could form joint ventures which are possible under the Mineral Leasing Act. However, there are limits on the amount of land that can be held, as ruled by the Solicitor of the Department of the Interior on November 12, 1971:

> Under Section 21 of the Mineral Leasing Act of 1920, as amended, a person, association, or corporation may take and hold directly only one oil shale lease, which shall not exceed 5,120 acres. If that lease should expire or terminate for any reason, or be transferred, the lessee would not, on account of the issuance of the prior lease, be barred from acquiring another oil shale lease.
>
> Sections 21 and 27(e)(1) of the Mineral Leasing Act of 1920, as amended, must be read together, and, when so construed, they permit a person, association, or corporation to take, hold, own, or control indirect interests in oil shale leases as a member of associations or as

a stockholder in corporations, each holding an oil shale lease, if those interests, together with acreage directly held, owned, or controlled under an oil shale lease, do not exceed in the aggregate 5,120 acres.

Under the excepting clause of Section 27(e)(1) of the Mineral Leasing Act of 1920, as amended, where a person is the beneficial owner of 10 percent or less of the stock or other instruments of ownership or control of an association or corporation holding an oil shale lease, that indirect interest would not be chargeable against his aggregate allowable oil shale lease acreage of 5,120 acres.

The Department's prototype leasing program encourages the development of any commercially viable option in which a lessee is interested. The tracts in Wyoming, for example, are believed to be uniquely amenable to in situ processing. At the present time, the Department's Bureau of Mines Energy Research Center in Laramie, Wyoming, is conducting a full range of research related to this process, including the environmental aspects. This research will be continued as will work related to waste management generated by mining followed by surface processing.

49. Lease Weak - Public Giveaway

One comment was received that stated that the oil shale lease was weak and constituted a "public giveaway" (18).

Response

The proposed oil shale lease has received very careful attention by the Department of the Interior over a long period of time. Since oil shale development could be the basis for a new industry, the lease was designed to protect the interests of all parties, the public, the Federal government, and the potential lessees. A fair return to the Nation from the Federal property committed to the program, a fair

return to lessees for their investment, and proper protection of the environment are all objectives of the prototype program. Earlier comments in this Section J have covered specific provisions in the lease which are designed to achieve these objectives. The Department of the Interior firmly believes that proposed prototype oil shale lease, including the environmental stipulations, does protect the public interest and is in no way a "public giveaway." Several provisions in the prototype lease are designed specifically for the proposed prototype program and it is not intended to include them in subsequent oil shale leases. Among these provisions are: (1) the offsetting of extraordinary environmental costs against royalties, (2) the crediting of certain expenditures against the 4th and 5th bonus installments and against minimum royalties during the 6th through 10th lease years, and (3) the relief from a portion of royalty on actual production prior to the 8th anniversary date.

50. Apparent Government - Industry Coalition

Comments were received that criticized the oil shale leasing program as being another example of subsidization of industry at the public's expense. An apparent government-industry coalition was criticized (49, 145).

Response

The fundamental concept of the oil shale program is development by private industry on Federal lands and under Federal supervision. The program has consequently been designed to encourage private development and, at the same time, to protect public interest.

To be successful in achieving its objectives, the program should be attractive to both private industry and Government under existing laws. However, no subsidy of this development has been requested and none will be given. The program does seek to establish a new cooperative relationship between the private and public sectors to ensure the compatibility of industrial development with environmental quality.

51. Protection of Mineral Rights

The ownership of minerals in 240 acres of land included in Tract C-a was questioned. The correspondents stated that the company does not wish in any way to inhibit the prototype leasing program if it can be assured that its mineral interests can be adequately protected in some way (56).

Response

Patent to the lands in question was issued to a homesteader, Clarence R. Snyder, on December 4, 1926, under the Act of July 17, 1914 (38 Stat., 509) entitled:

> "An Act to provide for agricultural entry of lands withdrawn, classified, or reported as containing phosphate, nitrate, potash, oil, gas, or asphaltic minerals."

The patent reserved to the United States "all oil and gas and shale or other rock valuable as a source of petroleum." In fact, the Act of July 17, 1914, permits the patenting under the non-mineral land laws of lands "withdrawn or classified as phosphate, nitrate, potash, oil, gas or asphaltic minerals, or which are

valuable for those deposits" only if the patent contains " a reservation to the United States of the deposits on account of which the lands were withdrawn or classified or reported as valuable...."

The lands were "classified as mineral lands, valuable as a source of petroleum and nitrogen" by the Director of the U.S. Geological Survey, May 23, 1916.

Circular 393, dated March 20, 1915, reprinted in 44 L.D. 32, pointed out there was at that time no authority for disposing of the mineral deposits reserved in agricultural patents under the 1914 Act. Paragraph eight of that Circular states:

> "The act provides that the deposits reserved in agricultural patents issued thereunder shall be subject to disposal by the United States only as shall be hereafter expressly directed by law. Although provisions are made in the act for the protection of the surface owner against damage to his crops and improvements on the land by reason of prospecting for, mining, and removing such reserved mineral deposits, these provisions can have no operation or effect until further legislation by Congress shall authorize disposition of the reserved mineral deposits and define the qualifications of those who may acquire such deposits. In the meantime there is no right to prospect, and no right to acquire such deposits can be in any way initiated."

The Mineral Leasing Act of February 25, 1920, was the "further legislation by Congress" needed to dispose of mineral deposits reserved in patents issued under the 1914 Act. Section 34 of that Act states that its provisions "apply to all deposits of ...oil shale... in the lands of the United States, which lands may have been or may be disposed of under laws reserving to the United States such deposits...."

Title to the oil shale thus remains with the United States and oil shale is properly subject to lease under the Mineral Leasing Act of 1920 as proposed in the Prototype Leasing Program. The question of whether title to oil shale includes title to inorganic fractions of the deposit as well as the organic fraction valuable as a source of petroleum has been answered affirmatively in Brennan vs Udall, 251 P. Supp. 12 (D. Colo. 1966).

K. Miscellaneous

1. Sufficiency of Public Notice

There was not sufficient public notice prior to the public hearings (140, 158, 161, 182, 195, 228, 290) and the timing of the hearings was inconvenient (83).

Response

Notice of the public hearings and the release and availability of the Draft Environmental Statement was published in the Federal Register on September 7, 1972. Announcement was made by news release on the same date that public hearings would held in Denver and Grand Junction, Colorado, Salt Lake City and Vernal, Utah, and Cheyenne and Rock Springs, Wyoming, during the week of October 9, 1972.

In addition, on September 14, 1972, the Oil Shale Task Force (Denver) sent notification to 57 separate news media (press, radio, television) in the three-State area announcing the forthcoming oil shale hearings.

The notice of September 7, 1972, announced that written comments would be received on the Draft Statement for a period of 45 days (until October 23, 1972) after publication of the notice. This deadline was later extended by the Secretary of the Interior to November 7, 1972, responding to comments received both in writing and at the public hearing requesting an extension in time.

The hearings were held on three separate days in six different locations in the oil shale region itself in order to minimize inconvenience and permit maximum participation by interested persons and organizations. The Denver, Colorado hearing, originally scheduled for October 10, 1972 only, was extended to October 11, to enable the

taking of additional testimony. Also, the record was held open for an additional 30 days to allow submission of written comments by those unable to speak at the hearings personally or those who did appear and wished to supplement their oral testimony.

2. Further Federal Oil Shale Leasing

The Final Statement should define as specifically as possible the decision-making process through which the Department of the Interior will evaluate the results of the prototype program to determine whether further Federal oil shale leasing is warranted. It is unclear from the Draft Statement when a critical evaluation of the environmental impact of commercial oil shale development would take place insofar as recommendations for further leasing is concerned. It was also inferred that a moratorium on further leasing would be held until a thorough evaluation of the prototype program was completed (7).

Response.

It is not possible at this time to specify precisely the schedule of decision-making steps which would be involved in a future proposal to lease additional federal lands for oil shale development. To begin with, no decision has been made to implement a prototype program. The nature and details of future decision-making cannot be projected until some knowledge and experience has been gained under a prototype program, if implemented. It should also be noted that, if the program is implemented and successful lease sales are held, investment decisions by private concerns will decide the rate of development on the six prototypes leases. A moratorium on further leasing, pending evaluation of all aspects,

including environmental impacts, of the prototype program, will be established in accordance with the policy stated in the Introductory Note contained in each of the six volumes in this Statement:

> If expansion of the Federal Oil Shale Leasing Program is considered at some future time, the Secretary of the Interior will carefully examine the environmental impact which has resulted from the Prototype Program and the probable impact of an expanded program. Before any future leases on public lands are issued, an Environmental Statement, as required by the National Environmental Policy Act, will be prepared.

3. Economic or Cost-Benefit Analyses

Requests were made for economic or cost-benefit analyses (6, 38, 39, 50).

Response.

The primary purpose of an environmental statement is to describe and assess the environmental effects of a proposed action and its alternatives. It is not intended to be an overall decision-making document. Accordingly, it is only one tool in the total decision-making process, to be considered along with economic and other factors in arriving at a final decision. An environmental statement should, of course, identify the purposes of the proposal and the benefits, economic or otherwise, expected as a result of implementation, in order to provide a basis for final evaluation of such purposes and benefits in light of the environmental effects and comparison of the advantages and disadvantages of the proposal with those of alternative courses of action. To engage in formal economic cost-benefit analyses in the environmental statement itself, would tend to obscure environmental analysis by transforming the statement into an overall decision-making document

centered around economic considerations and having a progrram justification focus.

The question is particularly relevant to the analysis of alternatives, which should be sufficiently detailed to permit comparative evaluation of the environmental benefits, costs, and risks of the proposed action and each reasonable alternative. Volume II, and Chapter IX of Volume III were prepared with this objective in mind.

4. Request for Another Environmental Impact Statement

Additional environmental statements should be prepared prior to approval of mining plans or special use permits (7, 33, 39).

Response

Draft environmental statements for the proposed prototype oil shale leasing program have already been prepared prior to this Final Statement. A program and preliminary draft environmental analysis was issued in June of 1971, for the informational core drilling, and a revised Draft Environmental Statement in September of 1972. The Department of the Interior has made every effort to consult and coordinate with the interested public, as shown by the material in this volume. The views and suggestions of others, obtained through the public hearings and review processes, have been utilized in revising the environmental impact study for issuance of a Final Environmental Statement. Another environmental statement is to be prepared if it is ever proposed that a leasing program should be entered into beyond the six proposed prototype

tracts covered in this proposal. The Final Statement is intended to be of sufficient scope and detail to cover the possible range of environmental effects of all activities related to prototype oil shale development, including approval of mining plans and issuance of special land use permits. Thus, at this time, it is not expected that additional environmental statements for such plans or permits will be prepared.

5. Previous Comments

The Department was criticized for not taking previous comments into consideration (39).

Response

The comments referred to above were submitted on the June 1971 preliminary Draft Statement and were published with the September 1972 Draft Statement (See Volume I, Chapter VIII). The matters raised by these comments were considered in the preparation of the September 1972 Draft and reconsidered and incorporated into this Final Statement, as indicated below. 1/

Environmental Impacts

Land and revegetation: Volume I, Chapter I, Section D, and Volume I, Chapter III, Section A.
Water Supply and Quality: Volume I, Chapter III, Section B.
Recreation: Volume I, Chapter III, Section F.
Full-scale industry: Volume I, Chapter III.
Wildlife: Volume I, Chapter III, Section D.

1/ All references are to September 1972 Draft Environmental Statement except as otherwise noted by FES (Final Environmental Statement).

Alternatives

Alternative prototype programs: Volume II, Chapter V, Section A.
Cancel/delay program: Volume II, Chapter V, Section A.
Increase oil inputs: Volume II, Chapter V, Section B.2.
Alternative energy sources: Volume II, Chapter V.
Fewer tracts: Final Environmental Statement, Volume III, Chapter IX, Section H.
Specific environmental provisions: Volume III, Chapter V.
Bonding: Volume III, Chapter I, Section C.4; Volume III, Chapter V.

6. Indian Claims

The fact there are no sizable Indian communities in the oil shale region does not imply that there will be no impact, since litigation may establish legitimate Indian claims to Piceance Basin lands (30).

Response

There are no known Indian claims to surface or mineral title in the Piceance Creek Basin. A thorough search of lands and minerals title records and mining claim records has been completed. Numerous mining claims are on record and are being investigated to determine their validity. A significant portion of the lands in Piceance Creek Basin have been cleared of title encumbrances. None of the proposed prototype tracts are encumbered with Indian claims.

IV. LIST OF REFERENCES (PUBLIC PARTICIPATION)

A. List of Groups and Individuals Submitting Written Comments

1. Federal Agencies

Reference No.

1. Bureau of Indian Affairs, U.S. Department of the Interior John O. Crow, Deputy Commissioner, Washington, D.C. 20242

2. Bureau of Land Management, Burt Silcock, Director, Washington, D.C. 20240

3. Bureau of Mines, U.S. Department of the Interior, O. M. Bishop, Office of the Chief, Intermountain Field Operation Center, Bldg. 20, Denver Federal Center, Denver, Colorado 80225

4. Bureau of Mines, U.S. Department of the Interior, Paul Zinner, Acting Director, Washington, D.C. 20240

5. Bureau of Outdoor Recreation, U.S. Department of the Interior, Jerome F. Anderson for James G. Watt, Director, Washington, D.C. 20240

6. Bureau of Reclamation, U.S. Department of the Interior, Ellis L. Armstrong, Commissioner of Reclamation, Washington, D.C. 20240

6a. Bureau of Sport Fisheries and Wildlife, U.S. Department of the Interior, F. V. Schmidt, Deputy Director, Washington, D.C. 20240

7. Environmental Protection Agency, Sheldon Meyers, Director, Office of Federal Activities, Washington, D.C. 20460

7a. Federal Power Commission, John N. Nassikas, Chairman, Washington, D.C. 20426

8. Geological Survey, U.S. Department of the Interior, J. R. Balsey, Acting Director, Washington, D.C. 20242

9. National Park Service, U.S. Department of the Interior, Theodore R. Swem, Assistant Director, Cooperative Activities, Washington, D.C. 20240

10. Office of Coal Research, U.S. Department of the Interior, George Fumich, Jr., Acting Director of Coal Research, Washington, D.C. 20240

11. Office of Emergency Preparedness. G. A. Lincoln, Director, Washington, D.C. 20504

Reference No.

12. Soil Conservation Service, U.S. Department of Agriculture, M. D. Burdick, State Conservationist, P. O. Box 17107, Denver, Colorado 80217

13. U.S. Atomic Energy Commission, Robert J. Catlin, Director, Division of Environmental Affairs, Washington, D.C. 20545

14. U.S. Department of Commerce, Sidney R. Galler, Deputy Assistant Secretary for Environmental Affairs, Washington, D.C. 20230

15. U.S. Department of Health, Education, and Welfare, Rulon R. Garfield, Regional Director, Region VIII, 19th and Stout Streets, Denver, Colorado 80202

16. U.S. Department of Housing and Urban Development, Michael T. Kastanek, Assistant Regional Administrator, Community Planning and Development, Federal Building, 19th and Stout Streets, Denver, Colorado 80202

17. U.S. Department of the Navy, Naval Petroleum and Oil Shale Reserves, J. P. Trunz, Jr., Commander, CEC, USN, Director, Washington, D.C. 20360

2. U.S. Congress

18. Vanick, Charles A., U.S. Representative from the 22nd District of Ohio, 2453 Rayburn Building, Washington, D.C. 20515

3. State Agencies

19. Colorado Department of Health, Roy L. Cleere, M.D., M.P.H., Executive Director, 4210 E. 11th Avenue, Denver, Colorado 80220

20. Colorado River Water Conservation District, by Kenneth Balcomb, Delaney and Balcomb, Attorneys, 829 Grand Avenue, Drawer 790, Glenwood Springs, Colorado 81601

21. Department of Economic Planning and Development, John T. Goodier, Chief of Mineral Development, 720 West 18th Street, Cheyenne, Wyoming 82001

22. State of California, Colorado River Board of California, Myron B. Holburt, Chief Engineer, 302 California State Building, 217 West First Street, Los Angeles, California 90012

Reference No.

23. State of Colorado, Division of Wildlife, Harry B. Woodward, Director, 6060 Broadway, Denver, Colorado 80216

24. University of Denver, Denver Research Institute, John J. Schanz, Jr., University Park, Denver, Colorado 80210

25. Wyoming Game and Fish Commission, James B. White, Commissioner, Cheyenne, Wyoming 82001

4. Environmental-Conservation Groups

26. Colorado Bowhunters Association, Inc., Gerald L. Egbert, Board of Directors, 2085 Nome Street, Aurora, Colorado 80010

27. Colorado Environmental Health Association, Raymond Mohr, Environmental Planning Commission, Denver, Colorado 80202

28. Colorado Environmental Legal Services, Inc., Gary E. Parrish, Box 207, Englewood, Colorado 80110

29. Colorado Open Space Council, Inc., V. Crane Wright, President, 1742 Pearl Street, Denver, Colorado 80203

30. Colorado Open Space Council, Inc., Carolyn R. Johnson, Chairman COSC Mining Workshop, Co-Chairman COSC Oil-Shale Committee, 1742 Pearl Street, Denver, Colorado 80203

31. Colorado Open Space Council, Inc., Sue Bollman, Vice-Chairman Mining Workshop, 5850 E. Jewell Street, Denver, Colorado 80222

32. Colorado Open Space Council, Inc., Charles Wanner, Wilderness Workshop, 1742 Pearl Street, Denver, Colorado 80203

33. The Conservation Foundation, Arthur A. Davis, Vice-President for Operations, 1717 Massachusetts Avenue, N.W., Washington, D.C. 20036

34. Daves Arboretum, M.C. Markham, Naturalist, Newark, Ohio

35. Denver Audubon Society, Allen W. Stokes, Jr., Oil Shale Workshop, 1742 Pearl Street, Denver, Colorado 80203

36. Environmental Policy Center, Bruce C. Driver, 324 C. Street, S. E., Washington, D.C. 20003

Reference No.

37. Natchitoches Audubon Society, Patricia J. Lewis, Secretary, 1042 Oma Street, Natchitoches, Louisiana 71457

38. National Audubon Society, Elvis J. Stahr, President, 950 Third Avenue, New York, New York 10022

__. National Wildlife Federation (co-filed with the National Resources Defense Council, Reference No. 39).

39. Natural Resources Defense Council, Inc., Thomas B. Stoel, Jr., and Edward L. Strohbehn, Jr., 1710 N Street, N.W., Washington, D.C. 20036 (co-filed with the Wildlife Federation and the Sierra Club).

40. Orleans Audubon Society, Dr. Carolyn R. Morrillo, President, New Orleans, Louisiana

41. Plan Aurora, Charles Parks, 15350 East Tenth Avenue, Aurora, Colorado 80010

42. Rocky Mountain Center on the Environment, Roger P. Hansen, Executive Director, 4260 West Evans Avenue, Denver, Colorado 80222

43. Rocky Mountain Sportsmens Federation, Elmer White, Vice President, P.O. Box 52, Westminster, Colorado 80030

44. Sierra Club, Enos Mills Group, Jorge E. Castillo, Attorney, Suite 2422 Prudential Plaza, 1050 Seventeenth Street, Denver, Colorado 80202

45. Sierra Club, Uinta Chapter, Sara Michl, Land-Use Chairman, 2169 Sherman Avenue, Salt Lake City, Utah 84108

__. Sierra Club (co-filed with the National Resources Defense Council, Reference No. 39).

46. Southwestern New Mexico Audubon Society, Norman O. Jette, President, P.O. Box 12, Pinos Altos, New Mexico 88053

47. Trout Unlimited, Robert M. Weaver, Executive Director of Colorado Council, 4260 E. Evans Avenue, Denver, Colorado 80222

48. Tucson Audubon Society, Lillian Pengry, Chairman, Conservation Legislation Committee, Tucson, Arizona

49. University of Colorado Wilderness Group, Jeffrey Poland, President, UMC 183-C, University of Colorado, Boulder, Colorado 80302

50. University of Wisconsin-Milwaukee, Department of Geography, Glen D. Weaver, Milwaukee, Wisconsin 53201

Reference No.

51. Utah Audubon Society, Arabelle McDonald, 611 South 1st East, Brigham City, Utah 84302

52. The Wilderness Society, Clifton R. Merritt, Director of Field Services, 4260 E. Evans Avenue, Denver, Colorado 80222

5. Private Industry

53. Amarillo Oil Company, E. S. Morris, President, Suite 800, Plaza One, P.O. Box 151, Amarillo, Texas 79105

54. American Petrofina, Inc., John R. Moran, Jr., Moran, Reidy, & Voorhees, Attorneys, 818 Patterson Building, Denver, Colorado 80202

55. APCO Oil Corporation, H. F. Boles, Vice President, Exploration and Minerals, 17th Floor Houston National Gas Building, Houston, Texas 77002

56. Bell Petroleum Company, Holland and Hart, Attorneys, 500 Equitable Building, 730 Seventeenth Street, Denver, Colorado 80202

57. Cameron Engineers, Russell J. Cameron, President, 1315 Clarkson Street, Denver, Colorado 80210

58. Colony Development Operation, John S. Hutchins, Manager, 1500 Security Life Building, Denver, Colorado 80202

59. Development Engineering, Inc., John B. Jones, Jr., President, 1827 Grant Street, Denver, Colorado 80203

60. Diamond Shamrock Oil and Gas Company, Avery Rush, Jr., President, P.O. Box 631, Amarillo, Texas 79105

61. Geokinetics, Inc., Mitchell A. Lekas, President, Suite 300, 1875 Willow Pass Road, Concord, California 94520

62. Humble Oil & Refining Company, C. S. Fleischmann, Manager, P.O. Box 2180, Houston, Texas 77001

63. Koch Exploration Company, R. T. Bick, President, Box 2256, Wichita, Kansas 67201

Reference No.

64. Marathon Oil Company, G. R. Schoonmaker, Vice President, Exploration, Finlay, Ohio 45840

65. Mesa Petroleum Company, J. O. Upchurch, Vice President, P.O. Box 2009, Amarillo, Texas 79105

66. Offshore Operators Committee, Austin W. Lewis, Attorney, Liskow & Lewis, 225 Baronne Street, New Orleans, Louisiana 70112

67. The Oil Shale Corporation, John A. Whitcombe, Senior Vice President, 1600 Broadway, Denver, Colorado 80202

68. Phelps Dodge Company, Warren E. Fenzi, Executive Vice President, 300 Park Avenue, New York, New York 10022

69. Rocky Mountain Oil and Gas Association, Warren J. Hancock, President, Box 1555, Billings, Montana 59103

70. Shell Development Company, Thomas Baron, President, P.O. Box 2463, Houston, Texas 77001

71. Signal Oil and Gas Company, W.H. Thompson, Jr., 2800 North Loop West, Houston, Texas 77018

72. Sohio Petroleum Company, H. Pforzheimer, Vice President, Midland Building, Cleveland, Ohio 44115

73. Sun Oil Company, Fred M. Mayes, Vice President Development Projects, P.O. Box 2880, Dallas,Texas 75221

74. The Superior Oil Company, B. E. Weichman, P.O. Box 1521, Houston, Texas 77001

75. Utah Resources International, Inc., John H. Morgan, Jr., President, 709 Walker Bank Building, Salt Lake City, Utah 84111

76. Harrington, D. D., 701 First National Bank Building, Amarillo, Texas 79101. (For unidentified Company in U.S. Oil Shale Company Group).

6. Private Citizens

Reference No.

77. A Concerned Citizen, Fort Collins, Colorado 80521

78. Aulton, Michael A., 1706 Larch Street, Fort Collins, Colorado 80521

79. Bailey, James A., Assistant Professor of Wildlife Biology, Colorado State University, Fort Collins, Colorado 80521

80. Barnhalt, Barbara, #265 Ellis Hall, Fort Collins, Colorado 80521

81. Battle, Margaret, 162 N. Pleasant Street, Newark, Ohio 44857

82. Bell, Tom, Editor, High Country News, Lander, Wyoming 82520

83. Bench, Dan W., 310 19th Street, Boulder, Coloradio 80302

84. Benedetti, Phyllis, Lake Hopatcong, New Jersey 07849 1/

85. Bires, Dennis E., 119 Wishart Drive, Beaver, Pennsylvania 15009

86. Boehme, Laurence M., Fort Collins, Colorado 80521

87. Bond, G. V., 12 Woodside Road, Fayettesville, New York 13066

88. Browne, Margaret, 955 Broadway, Boulder, Colorado 80302

89. Burchett, Stuart, Department of Chemistry, Southwestern State College, Weatherford, Oklahoma 73096

90. Burris, Tom, Box 99, RFD #4, Jefferson, Ohio 44047

91. Campbell, Scott, 2130 W. Prospect Street, Fort Collins, Colorado 80521

92. Casbar, Peter, 224 13th Street, Palisades Park, New Jersey 07650 1/

93. Caulfield, Doug, 2207 W. Oak Court, Apartment 1912, Fort Collins, Colorado 80521

94. Cavney, Kevin, Boulder, Colorado 80302

95. Chambers, Cliff, 709 Wagner Drive, Fort Collins, Colorado 80521

96. Clifford, Glen, 4820 T-Bird Circle #209, Boulder, Colorado 80303

1/ Identical letter as that received from Barbara Barnhalt. Her letter only reproduced in this volume.

Reference No.

97. Colgrove, Diane E., 1204 Stearns, 600 30th Street, Boulder, Colorado 80302

98. Colton, J. Blane, 593 S. Ogden, Denver, Colorado 80209

99. Connard, Lillian, Des Moines, Iowa 50309

100. Crowe, Robert M., 1212 Pine, Boulder, Colorado 80302

101. Custin, Henry W., B-207 Green Hall, Fort Collins, Colorado 80521 1/

102. Dann, John A. and Susan, 760 Clermont, Denver, Colorado 80220

103. Dawdy, Doris, 1312 Morgan Street, Fort Collins, Colorado 80521

104. Diemer, Corinne, Box 95, Leadville, Colorado 80461

105. Dillon, Mark, 214B Green Hall, Fort Collins, Colorado 80521 1/

106. Edwards, Bev, 8810 Birdwood, Houston, Texas 77036

107. Edwards, Nancy, 2034 W. Plum C-4, Fort Collins, Colorado 80521

108. Enyeart, Walt, Box 621, Georgetown, Colorado 80444

109. Erwin, Mark D., 611 Durward Hall, Colorado State University, Fort Collins, Colorado 80521 1/

110. Fendrich, Karen, Fort Collins, Colorado 80521 1/

111. Finlay, Terri, Oak Ridge, New Jersey 07438 1/

112. Finley, Joan, #130 Ellis Hall, Fort Collins, Colorado 80521 1/

113. Forselius, Randilyn, 2315 E. 7th Avenue, Denver, Colorado 80206

114. Foster, John C. Jr., 13995 W. 21st Street, Golden, Colorado 80401

115. Garule, Ronald, Fort Collins, Colorado 80521 1/

116. George, H. Glenn, 1535 Hanover, Aurora, Colorado 80010

117. Gless, George E., 2940 Thirteenth Street, Boulder, Colorado 80302

118. Goddard, Sally J., 1045 Arapahoe, Boulder, Colorado 80302

119. Gow, Keith J., Ellis Hall, Fort Collins, Colorado 80521 1/

1/ Identical letter as that received from Barbara Barnhalt. Her letter only reproduced in this volume.

Reference No.

120. Graham, Pamela Sue, Allison Hall #261, Fort Collins, Colorado 80521

121. Gray, Evelyn M., 830 20th Street, #B-1, Boulder, Colorado 80302

122. Green, Timothy K., 8307 Ames Way, Arvada, Colorado 80003

123. Gustafson, Robin H., Box 234, Breckenridge, Colorado 80424

124. Haley, Jay S., Boulder, Colorado 80302

125. Hamilton, Bruce, 310 Peterson Street, Fort Collins, Colorado 80521

126. Harber, Kay, Environmental Corps (ECO), Box 711 Student Center, Colorado State University, Fort Collins, Colorado 80521

127. Hener, Karen, Box 4031, Aspen, Colorado 81611

128. Himes, Duncan and Carol, 4776 Heatherwood Court, Boulder, Colorado 80302

129. Hotchkiss, #143 Baker Hall, University of Colorado, Boulder, Colorado 80302

130. Houpt, Doris, 16 West Ridge Road, Media, Pennsylvania 19063

131. Huett, Gary, 230 N. 11th Avenue, Brighton, Colorado 80601

132. Isaacson, Cherrelyn and Amy Metsker, Fort Collins, Colorado 80521 1/

133. Janelle, Bob, B-214 Green Hall, Fort Collins, Colorado 80521 1/

134. Japhet, Michael L., 1044 Pleasant Street, Boulder, Colorado 80302

135. Journay, Frank, 271 So. Blvd., Saddle Brook, New Jersey 07662 1/

136. Jurgens, Esther B., 1203 Third Avenue, Longmont, Colorado 80501

137. Kerharich, Rud, 848 17th Street, Boulder, Colorado 80302

138. Kinghorn, Steven and Nancy, 1634 Walnut Street, Boulder, Colorado 80302

139. Kiver, Eugene, Rt. 3, Box 76, Cheney, Washington 99004

1/ Identical letter as that received from Barbara Barnhalt. Her letter only reproduced in this volume.

Reference No.

140. Knudson, Ruthann, Editor, Newsletter of Lithic Technology, Washington State University, Pullman, Washington 99163

141. Louda, Mira, C210 Green Hall, Colorado State University, Fort Collins, Colorado 80521 1/

142. Lowenstein, Daniel, 302 Arnet Hall, University of Colorado, Boulder, Colorado 80302

143. Lowery, Dan, 152 Arnett Hall, Boulder, Colorado 80302

144. Lubchenco, Richard and Harriet, 901 W. Mountain Avenue, Fort Collins, Colorado 80521

145. McCargo, David Jr., 3300 So. Washington Street, Englewood, Colorado 80110

146. McCormick, John L., 342 C. Street, S.E., Washington, D.C. 20003

147. McCoy, F. C., 12734 Cullen Street, Whittier, California 90602

148. McElvain, Diane. 1254 Penna, Denver, Colorado 80203

149. McMillan, Ruth S., 103 Mechanic Vall, North East, Maryland 21901

150. Mercer, Mark Alan, 228 Newson Hall, Fort Collins, Colorado 80521

151. Merrill, Daniel R. and Dorothy B., RD1, Hawley, Pennsylvania 18428

152. Meyer, Robert, 116-1 Nimitz Drive, West Lafayette, Indiana 47906

153. Model, Robert, Majo Ranch, Valley, Wyoming 82414

154. Mork, Stuart E., Edwards Hall, Room 211, Fort Collins, Colorado 80521

155. Nettles, M. L., 2985 18th Street, Boulder, Colorado 80302

156. Nielsen, Wayne, Nielsen and Associates, P.O. Box 3241, Boulder, Colorado 80303

157. Okenreider, Mel, Lake Hopatcong, New Jersey 07849 1/

158. Osborn, Mark, 1729 Athens, Boulder, Colorado 80302

159. Padelford, L. J., 2504 Hancock Street, Bellevue, Nebraska 68005

1/ Identical letter as that received from Barbara Barnhalt. Her letter only reproduced in this volume.

Reference No.

160. Patchett, Docia I. and Ernestine I. Smith, 1524 Fair Oaks Ct. Santa Rosa, California 94504

161. Penner, Marcia, Hallett Hall, Box 303, Boulder, Colorado 80302

162. Petit, Barbara, 3635 Goodell Lane, Fort Collins, Colorado 80521

163. Phelan, James L., Staff Attorney, University of Denver, College of Law, 209 16th Street, Denver, Colorado 80204

164. Phillips, Anne, Room 133 Ellis Hall, Fort Collins, Colorado 80521 1/

165. Plymire, James, Linville, North Carolina 28646

166. Powell, Rose Anne, 318 West Laurel Street, Fort Collins, Colorado 80521

167. Powell, Michael and Carol, 715 Parker 2-C, Fort Collins, Colorado 80521

168. Reiswig, Barry, 710½ Colorado Avenue, Fort Collins, Colorado 80521

169. Rinker, Marcia Kay, Corbett Hall H311, Fort Collins, Colorado 80521 1/

170. Riske, Susan, Rt. 1, Box 440C Laramie, Wyoming 82070

171. Roark, Robert J., 931 Alpine Avenue, Boulder, Colorado 80302

172. Rodda, Gordon, 230 Andrews Hall, Boulder, Colorado 80302

173. Ruehle, Walter J., 14000 E. Progress Way, Denver, Colorado 80232

174. Satterthwaite, Pennington, 439 East 51st Street, New York, New York 10022

175. Shade, Janie, 225 Ingersoll Hall, Fort Collins, Colorado 80521

176. Shea, Daniel H. and Mary, 31 Pond Street, Apt. #13, Waltham, Massachusetts 02154

177. Sheldon, Dean E. Jr., 402 Northampton, Huron, Ohio 44839

178. Simkowski, Nancy, Inst. of Behavioral Sciences, University of Colorado, Boulder, Colo 80302

1/ Identical letter as that received from Barbara Barnhalt. Her letter only reproduced in this volume.

Reference No.

179. Smith, Ruth T., 1231 Hoover Street, Menlo Park, California 94025

180. Spratt, Michael J., Fort Collins, Colorado 80521 1/

181. Stegner, Patricia, 613 S. Sherwood, Fort Collins, Colorado 80521

182. Stinson, Tom, Box 115 Libby Hall, University of Colorado, Boulder, Colorado 80302

183. Strasser, A. W., Rocky Run Road, Hawley, Pennsylvania 18428

184. Strong, Charles D., 1569 Eudora Street, Denver, Colorado 80220

185. Summers, W., 3415 Newton Street, Denver, Colorado 80221

186. Swanson, John R., P. O. Box 922, Berkeley, California 94701

187. Szkola, Randy, 212B Green Hall, Fort Collins, Colorado 80521 1/

188. Tischler, Sanford, 1504 South Whitcomb, Fort Collins, Colorado 80521

189. Todd, Jeffrey W., 1201 W. Plum, Apartment C, Fort Collins, Colorado 80521

190. Travis, Maury M., Consulting Petroleum Technologist, 901 Sherman Street, Denver, Colorado 80203

191. Twomey, Jill M., 1135 Lincoln, Boulder, Colorado 80302

192. Tyers, Debra, Room A210, Green Hall, Fort Collins, Colorado 80521 1/

193. Veeneman, Robert, P.O. Box 234, Breckenridge, Colorado

194. Walter, Laura, 946½ Pratt Street, Longmont, Colorado 80501

195. Webb, William H., 1180 Edinboro Drive, Boulder, Colorado 80303

196. Wenk, Robin Alexander, 593 S. Ogden, Denver, Colorado 80209

197. Wight, Susan, 1333 University Avenue , Boulder, Colorado

198. Wilson, Richard C., 211 Nimitz Drive, Des Plaines, Illinois 60018

199. Young, David L., 124 Briarwood Road #722, Fort Collins, Colorado 80521

1/ Identical letter as that received from Barbara Barnhalt. Her letter only reproduced in this volume.

Reference No.

7. Miscellaneous

200. American Forestry Association, William E. Towell, Executive Vice President, 1319 Eighteenth Street, N.W., Washington, D.C. 20036

201. Jirak, Edwin A., Mayor Town of Meeker, Colorado

202. League of Women Voters of Colorado

B. List of Groups and Individuals Appearing Before Public Hearings (Listed in Order of Appearance)

1. Denver, Colorado, Denver Federal Center, Auditorium
October 10-11, 1972

Reference No.

203. Thomas Ten Eyck, on behalf of Colorado Governor John Love

204. Francis Brush, Democratic Candidate for U.S. Representative from Colorado

205. Pete Barrows, Colorado Division of Wildlife

206. John H. Tippit, Rio Blanco & Rio Verde Natural Gas Companies

207. Paul M. Dougan, Equity Oil Company

208. R. E. Foss, Sun Oil Company

209. Richard D. Ridley, Garrett Research & Development

210. Kenneth Canfield, Atlantic Richfield Company

211. John S. Hutchins, Colony Development Operation

212. John B. Tweedy, The Oil Shale Corporation

213. John Moran, Jr., for American Petrofina, Incorporated

214. Jorge E. Castillo, Sierra Club

215. Theodore Ellis, Sierra Club

216. Maury Travis, Travis International

217. John W. Rold, Colorado Geological Survey

218. Richard T. Ward, Colorado State University

219. Bruce Hamilton, Student, CSU Environmental Corps

220. Jeffery Todd, CSU Environmental Corps

221. Allen W. Stokes, Denver Audubon Society

222. Richard Speed, Environmental Action of Colorado

Reference No.

223. Cliff Chambers, Student, Colorado State University

224. Edwin J. Merrick, National Wildlife Federation

225. Ben Weichman, Superior Oil Company

226. Myron L. Corrin, Colorado State University

227. Charles Warner 1/, Wilderness Workshop, COSC

228. Hester McNulty, Colorado League of Women Voters

229. Eugene Weimer, Colorado Citizens for Clean Air and Energy Workshop, COSC

230. Richard H. Daley, Citizen, Fort Collings, Colorado

231. James L. Phelan, Citizen, Denver

232. Estella Leopold 2/, Denver Audubon Society

233. Edward Connors, Water Workshop, Colorado Open Space Council, Inc.

234. Gary Parrish, Plan Aurora (Colorado)

235. Charles D. Hoertz, Ashland Oil, Inc.

236. Jean Foster 3/, for Carol Snow

237. Donald Davis, Citizen, Denver

238. Mike Lekas, Geokinetics, Inc.

239. Gordon Rodda, University of Colorado Wilderness Group

240. Raymond Mohr, Colorado Environmental Health Association

241. Donald Davis, Colorado Grotto of the National Speleological Society

242. Libby Goodwin, Boulder Audubon Society

243. Betty Willard, Citizen

244. Joan Foster 4/, Housewife

245. Sue Bowman 5/, Citizen

246. Bob Weaver, Trout Unlimited, Colorado Council

1/ Charles Warner should be Charles Wanner
2/ Estella Leopold should be Robert Turner
3/ Jean Foster should V. Crane Wright
4/ Joan Foster should be Joanne P. Foster
5/ Sue Bowman should be Sue Bollman

Reference No.

247. Carolyn Johnson, Mining Workshop, Colorado Open Space Council, Inc.

248. V. Crane Wright, Colorado Open Space Council

2. Rock Springs, Wyoming, Outlaw Inn Motel, October 10, 1972

249. Teno Roncalio, U.S. Representative from Wyoming

250. Bruce Marker, Wyoming Department of Game and Fish

251. Marion E. Loomis, Wyoming Department of Economic Planning & Development

252. Mr. Patton for Wyoming U.S. Senator Clifford Hansen

253. Steve Majhanovich, Wyoming State Representative

3. Cheyenne, Wyoming, Little America Motel, October 12, 1972

254. Stanley K. Hathaway, Governor of Wyoming

255. William J. Thompson, representing Senator Clifford P. Hansen of Wyoming

256. U. Dean Allred, on behalf of G. R. Schoonmaker Marathon Oil Company

257. John W. Hand, Mintech Corporation

4. Vernal, Utah, Vernal Junior High School, October 12, 1972

258. Gordon Harmston, Department of Natural Resources

259. Howard Ritzma, Utah Geological Survey

260. Bert L. Angus, Uintah County Commission

261. Buell Bent, City Planning of Vernal

262. Glenn Cooper, Vernal Area Chamber of Commerce

263. Charles R. Henderson, Citizen, Uintah Basin, Utah

5. Salt Lake City, Utah, State Office Building, October 13, 1972

Reference No.

264. Wallace F. Bennett, U.S. Senator from the State of Utah (Letter read into the hearings record by James H. Day, Director, Office of Hearings and Appeals)

265. Paul Dougan, Equity Oil Company

266. Frank J. Allen, Western Oil Shale Corporation

267. Edwin J. Merrick, National Wildlife Federation

268. Midge Collins, Citizen, Provo, Utah

269. Leslie A. Jones, Citizen, Heber City, Utah

270. Harold Lamb, Utah Audubon Society

271. Louis H. Yardumian, Oil Shale Corporation

272. Max D. Eliason, Skyline Oil Co.

273. John Morgan, Jr., Utah Resources International Company

274. Cleon Feight, Division of Oil and Gas Conservation Board

275. Howard R. Ritzma, Utah Geological Survey

6. Grand Junction, Colorado, City Hall Auditorium October 13, 1972

276. R. W. Buchwald, Jr., Sun Oil Company

277. Frank Cooley, Oil Shale Regional Planning Commission

278. John R. Moran, Jr., American Petrofina Company of Texas

279. Russell J. Cameron, Cameron Engineers

280. J. W. Rogers, Aspen Pitkin County League of Women Voters and Grand Junction League of Women Voters

281. Bill Brennan, Board of County Commissioners in Rio Blanco County

282. Tam Scott, Colorado Rivers Council

Reference No.

283. Norman Allen, Colorado Sportsmen's Association

284. Diane Smith, Citizen

285. Joan Nice, Executive Committee of the Roaring Fork Group of the Sierra Club

286. James Smith, Jr., Citizen

287. Roland Fischer, Colorado River Water Conservation District

288. Gerald P. Wood, Colorado Department of Health

289. Gerald P. Wood, presenting Mr. Kirkpatrick's statement from the Colorado Air Pollution Control Commission

290. Ron Gitchell, Meeker Town Council and the Chamber of Commerce

291. Nyla Kladder, Audubon Society of Western Colorado

292. Ira J. Kowal, Citizen, statement read by Nyla Kladder

293. Bob Chancellor, Rio Blanco Natural Gas Company, speaking as an individual

294. Pat Halligan, Oil Planning Commission

295. Jack Roadifer, Citizen, Western Colorado

C. List of Hearings Exhibits and Of Other Supplemental Material Submitted

Reference No.

C-1 Air Quality Implementation Plan for State of Colorado. Colorado Department of Health, Air Pollution Control Division, 4210 East Eleventh Avenue, Denver, Colorado 80220 (1972).

C-2 Bell Petroleum Company Petition for Decision and Brief in Support Thereof to Director, Bureau of Land Management.

C-3 Clean Air Act, Sierra Club v. Ruckelshaus Civ. Action No. 1031-72 (D.D.C. May 30, 1972). Submitted by Colorado Open Space Council, Inc., V. Crane Wright, President.

C-4 Colorado Air Quality Control Regulations and Ambient Air Quality Standards. Colorado Air Pollution Control Commission, Colorado Department of Health, 4210 E. 11th Avenue, Denver, Colorado 80220 (1972).

C-5 Considerations in Formulating a Rational Oil Shale Policy. Theodore J. Ellis, Assistant Professor of Economics, Adams State College, Alamosa, Colorado (1972). (Denver Exhibit No. 5).

C-6 Energy Resources Map of Wyoming, Geological Survey of Wyoming, Dan Miller State Geologist, in Cooperation with the Wyoming Department of Economic Planning and Development, compiled by Donald W. Lane, Forrest K. Root, and Gary B. Glass (1972).

C-7 Environmental Impact Statement; Notice of Public Hearing, Department of the Interior, Office of Hearings and Appeals, Federal Register, Vol. 37, No. 174, pp. 18098-9, Thursday, September 7, 1972. (Denver Exhibit No. 1).

C-8 Environmental Inventory of a Portion of the Piceance Creek Basin in Rio Blanco County Colorado, prepared by the Environmental Resources Center, Colorado State University, Fort Collins, Colorado, for Cameron Engineers, Inc., Denver, Colorado, 327 pp., December 1971.

C-9 Proposed Prototype Oil Shale Leasing Program, Written Comments, submitted by John S. Hutchins, Manager, Colony Development Operation, Atlantic Richfield Company, Operator The Oil Shale Corporation, November 1, 1972.

Reference No.

C-10 Rules and Regulations Governing the Development and Production of Crude Oil and Gas from Bituminous Sandstone and Crude Shale Oil (Kerogen) from Oil Shale and Surface Land Reclamation Regulations Relating Thereto. Submitted by Cleon Feight, Division of Oil and Gas Conservation. (Salt Lake City Exhibit No. 5).

C-11 Rules and Regulations Pertaining to Radiation Control. State of Colorado, Colorado State Board of Health, OR-RH (6-70-25), effective date July 1, 1970.

C-12 Statement by Howard R. Ritzma, Committee on Environmental Problems of Oil Shale, State of Utah, to Oil Shale Task Force, U.S. Department of the Interior, Vernal, Utah, October 12, 1972. (Vernal Exhibit No. 1).

C-13 Statement of Rio Blanco Natural Gas Company and Rio Verde Natural Gas Company, October 10, 1972.

C-14 Statement by Russell J. Cameron, President, Cameron Engineers, Inc., Denver, Colorado for Presentation at Public Hearings on Draft Environmental Statement Concerning the Department of the Interior's Proposed Prototype Oil Shale Leasing Program, October 13, Grand Junction, Colorado. (Grand Junction, Colorado Exhibit No. 1).

C-15 Skyline Oil Company, Annual Report, Fiscal Year ended May 31, 1972, 21 pp. (Salt Lake City Exhibit No. 1).

C-16 Statement of Skyline Oil Company on the Draft Environmental Statement for the Proposed Prototype Oil Shale Leasing Program. Max D. Eliason, 21 pp., Salt Lake City, Utah, October 13, 1972. (Salt Lake City Exhibit No. 2).

C-17 Synthetic Pipeline Gas Potential from Green River Oil Shales of Uinta Basin, Utah. (Map) submitted by John Morgan, Jr., President of Utah Resources International Company, 709 Walker Bank Building, Salt Lake City, Utah. (Salt Lake City Exhibit No. 4).

C-18 The Myth of So-Called, Mis-Named "Oil Shale". Maury M. Travis, Travis Research International, 6 pp., October 10, 1972. (Denver Exhibit No. 3).

C-19 The Potential Role of Oil Shale in the U.S. Energy Mix: Questions of Development and Policy Formulation in an Environmental Age. Theodore J. Ellis, Ph.D Dissertation, Colorado State University, Fort Collins, Colorado 80521, September 1972. (Denver Exhibit No. 4).

Reference No.

C-20 Total Oil in the Oil Shale, Uinta Basin, Utah. (Map) submitted by John Morgan, Jr., President of Resources International Company, 709 Walker Bank Building, Salt Lake City, Utah. (Salt Lake City Exhibit No. 3).

C-21 Water Quality Standards and Stream Classification. Water Pollution Control Commission, Colorado Department of Health, September 1, 1971.

C-22 Written Comments of the Oil Shale Corporation on the Draft Environmental Statement, Prototype Oil Shale Leasing Program. Submitted by the Oil Shale Corporation, 1600 Broadway, Denver, Colorado, November 6, 1972, 88 pp.

C-23 An Interim Compilation of Sociometric Data on Garfield, Mesa and Rio Blanco Counties. Compiled by Norman Wengert, Ph.D., 1972.

C-24 Impact on Air Quality from Oil Shale Development, prepared by Engineering-Science, Inc., 7903 Westpark Drive, McLean, Virginia, January 5, 1973.

C-25 Comments of Glenn D. Weaver, submitted with the comments from The Conservation Foundation (33).

* U.S. GOVERNMENT PRINTING OFFICE : 1973 O—517-966